INTERNATIONAL

MARINE ENGINEERING

Published Monthly by ALDRICH PUBLISHING CO.

461 EIGHTH AVENUE, NEW YORK — 31 CHRISTOPHER ST., LONDON, E. C.

H. L. Aldrich, President and Treasurer — Assoc. Member of Council, Soc. N. A. and M. E.
George Slate, Vice-President
E. L. Sumner, Secretary
E. J. P. Benn, Director and Publisher — Associate Inst. N. A.

Edited by H. H. Brown, A. M. Inst. N. A.
Member Soc. N. A. and M. E.

Vol. XXII — JANUARY, 1917 — No. 1

Federal Shipping Board

ANNOUNCEMENT of the following nominees for the new Federal Shipping Board was made by President Wilson on December 22: William Denman, San Francisco, Cal., for a term of six years; Bernard N. Baker, Baltimore, Md., for a term of five years; John A. Donald, New York, for a term of four years; James B. White, Kansas City, Mo., for a term of three years, and Theodore Brent, New Orleans, La., for a term of two years. These names have been sent to the Senate for its approval, and as soon as ratified it is expected that the new board will make its headquarters in the port of New York.

As this is the first Board of its kind which has been established in the United States with powers for building up and regulating American shipping in the world's trade, it should receive the earnest support and coöperation of all shipping interests. Ample opportunity will be given to the Board to test its authority, and upon its success will rest, in a large measure, the future development of the American merchant marine.

Material and Labor Markets Hamper Naval Construction

THE amount of shipping now under way at navy yards in the United States shows an increase over previous years, both as regards the number of vessels and their total value. The greatest difficulty has been experienced, however, in avoiding serious delays in the construction of these vessels, due to the abnormal conditions existing in both the material and labor markets. According to statements made by the Chief of the Bureau of Construction and Repair in his annual report to the Secretary of the Navy, there is available only a limited number of skilled men in the shipbuilding trades, and, as these have been in great demand in the various private shipbuilding establishments where an unprecedented volume of merchant tonnage is under construction, it has proved impracticable to obtain men to increase the navy yard forces to the point warranted by the large amount of work in hand. In fact, difficulty has been experienced in avoiding serious depletion of the forces already employed, as the opportunities existing in private plants for increased earnings through overtime work form an inducement which goes far to offset that possessed by government employment. This condition promises to become more acute when the large volume of work involved in the new naval program is taken in hand, as there appears to be no reason to look for a decrease in the demand for additional new tonnage for the merchant marine.

"Old Mac's" Advice

ELSEWHERE in this number will be found the first of a series of articles which deal with the practical side of drawing office work. "Old Mac" exemplifies the capable, practical old ship draftsman, who knows from hard knocks in the past that finally the design of a ship is a compromise and that to make any kind of headway in actual construction what is called "good practice" must be accepted and experimental analysis discouraged. He does some things well enough that the man who tries to analyze cannot do at all, because the problem is too complex, life is short, and a ship is built for a profit.

The college boy who comes into the office worries about things with which he will never be intrusted. The luxury of experimenting and theorizing is not his. "Old Mac" serves the very good purpose of holding down the young fellow and forcing him to accumulate enough of this "good practice" so that he can be a good assistant until his mature judgment fits him to take on heavier work. "Old Mac" is jealous of his practical knowledge, and, as he says, it is not to be found in books, so let us listen to what he has to say.

Readers of this Magazine Threatened with an Unjust Tax

ON December 9 Representative Randall of California introduced in Congress a rider on the Post-Office Appropriation Bill, which proposes to apply the zone system, as applied to parcel post, to all second-class mail matter.

If this bill is enacted, the result will be that instead of the present flat rate of one cent per pound for postage, for the delivery of this magazine to its readers in any part of the United States, the postal rate will be based on the distance of transportation of the magazine. In other words, American citizens who live remote from publication centers will be taxed as high as 6 cents per pound postage on all of their magazines, periodicals and newspapers.

We cannot believe that any of our readers will willingly submit to such an unfair and unjust method of taxation. To prevent this, write or telegraph immediately to your Congressman expressing your disapproval of this measure.

"I Told You So!"

WHEN the question of assessing tolls on vessels passing through the Panama Canal was under consideration by a Congressional committee the publisher of this magazine urged the members of the committee in the strongest terms possible not to assess tolls upon a net tonnage basis, but to use a more scientific method based upon the actual earning capacity of the vessels, and described as a "block displacement" method.

As matters now stand, Panama Canal tolls are assessed according to the net registered tonnage of the ship, and not according to the Panama Canal tonnage, which is measured by the earning capacity of the cargo-carrying space of the ship. The result is that ships that were brought in under the act of 1914, which permitted the entry under the United States registry of foreign purchased ships, are coming in under a less net registered

Generated on 2024-08-12 19:15 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

tonnage than they would have if the United States rules applied.

The net registered tonnage of a vessel bears no relation whatever to the earning capacity of the ship. The result is that certain cargo-carrying spaces in these ships are excluded in the tonnage measurements. In the case of the English shelter deck steamers, for instance, all cargoes carried on the shelter deck are excluded from the tonnage measurements, and as a result the English ships are getting an advantage in tolls at the canal.

The difference in the tolls which are actually collected at the Panama Canal under present registered tonnage conditions, according to statements recently made by Major-General Goethals, is about 30 percent less than it should be. A bill is now before Congress to have this condition modified, and, if so, the revenues of the Canal will far exceed the operating expenses, and it will soon be possible to pay part of the interest on the investment. It is not too late to remedy this folly, and immediate steps should be taken to bring this about.

1918 Naval Program

As the Naval Appropriation Act for the fiscal year 1917, recently approved by Congress, stands out beyond all precedent in the entire history of the United States Navy, careful consideration should be given to the continuation of this building policy during the following years.

In his annual report, the Secretary of the Navy points out that for the first time the policy of a continuing program for new construction has been adopted by Congress. In all its essential features the three-year program authorized on August 29, 1916, is that recommended originally to be executed in five years. The 813,000 tons of new construction authorized is greater than the total of the authorization of the ten preceding acts. The 377,000 tons to be begun as soon as possible is nearly five times the average of the preceding ten years. The total appropriation of $313,384,212 (£64,250,000) is more than twice as large as the amount carried by any previous appropriation bill. The execution of this program will give the navy the following vessels, completed and in commission in 1921: Battleships, first line, 27; battle cruisers, 6; battleships, second line, 25; armored cruisers, 9; scout cruisers, 13; cruisers, first class, 5; cruisers, second class, 3; cruisers, third class, 10; destroyers, 108; fleet submarines, 12; coast submarines, 130; monitors, 6; gunboats, 18; supply ships, 4; fuel ships, 15; transports, 5; tenders to torpedo vessels, 6; special types, 8; munition ships, 2. The foregoing numbers are based on the General Board's estimate of survival for the present vessels of the navy.

For the fiscal year 1918 the Secretary of the Navy recommends the construction of 42 vessels, as against 77 vessels recommended by the General Board. The vessels recommended by the Secretary are as follows: 3 battleships; 1 battle cruiser; 3 scout cruisers; 15 destroyers; 4 fleet submarines; 14 coast submarines; 1 fleet submarine tender; 1 destroyer tender. In contrast to this, the General Board recommends 4 battleships; 2 battle cruisers; 4 scouts; 20 destroyers; 9 fleet submarines; 18 coast submarines; 1 fuel ship; 1 transport; 1 destroyer tender; 1 fleet submarine tender; 1 gunboat; 12 mine sweepers; 1 supply ship and 2 seagoing tugs.

The Secretary of the Navy gives as his principal reason for recommending a smaller program than that of the General Board the lack of skilled labor and difficulty in promptly obtaining material, and he believes that the program which he has recommended is as large as can be constructed unless work on merchant ships is abandoned and the building ways thus employed are utilized for naval construction.

Although everyone is fully aware that the present facilities of both private and Government shipyards are taxed to their utmost capacity, and that the conditions of the labor and material markets are causing delays, nevertheless if the country were assured of a continuing program based more closely on the recommendations of the General Board, we have no doubt that these difficulties would be easily overcome. Neither shipbuilders nor steel makers, however, can be expected to be prepared to deal with haphazard spurts in naval construction.

Reinforced Concrete in Ship Construction

(Communicated)

In a recent issue of MARINE ENGINEERING I noticed an article regarding Norwegian concrete barges and a short comment by a naval engineer, who stated that although numerous barges of this kind had been built in this country and the Panama Canal Zone their use had not been an unqualified success, and that the possible advantages in cost would be more than counteracted by increased cost of propulsion due to the heavier weight of the vessel.

There is, without question, a great future ahead for reinforced concrete in ship construction. The first attempts have necessarily been crude and have therefore not always been entirely successful. However, we must not forget that all great inventions, especially in ship construction, have been the results of scientific development of ideas which often were introduced by laymen in a very crude form and were later, with the assistance of experienced marine engineers, transformed into the great successes of the present day.

I have made the building of concrete ships one of my life's problems and have carefully studied the scientific principles which must be adopted in order to insure success. Not only for the construction of smaller vessels as barges and scows is concrete an entirely suitable material, but also for large ocean-going ships will its use be perfectly safe and extremely advantageous.

The principal faults of all previous attempts of concrete ship construction have been that concrete builders tried to use everyday methods and means in design and mixing and applying the materials. Most of these vessels were built of ordinary concrete mixed and placed in the common way and the special requirements of ultimate service were not sufficiently taken into consideration. The designs were made without consultation with marine engineers and the strains which the empty and loaded ship had to resist under all the different and changing conditions were only more or less intelligently guessed at.

In spite of all this, however, satisfactory results have been obtained in most cases, and therefore the subject is worthy of careful consideration and encouragement, especially at these times when the production of freight ships is one of the greatest problems of all nations.

So far, two methods have been used for the construction of concrete barges:

The first method consists in building an inside and outside form for the ship's hull, and between these forms (which were separated to allow for intended wall thickness) the necessary reinforcement was placed. Then a concrete, composed of Portland cement, sand and crushed stone, or gravel, was poured in a semi-liquid condition to fill the forms and to encase the steel reinforcement. After the concrete had sufficiently hardened, the forms

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

were removed and the barge was finished by pouring bulkheads, division walls, and decks, etc., in similar manner.

This method resulted in extremely clumsy and heavy vessels which can only be used for sand and construction barges. The ship itself is unelastic, and in collision with wharfs and other vessels, etc., dangerous cracks develop which are difficult to repair and which will often result in loss of the entire ship.

The second method consists in using a light steel skeleton, placing over the outside of the same an expanded metal or wire fabric and finishing the hull by plastering over this sheathing a rich mortar coating in the same manner as light curtain and partition walls are formed in fireproof building construction.

This method is a great improvement over the first one but can only be used for smaller boats, launches, etc., and of course is practically out of question for freight barges.

I have invented and developed a series of entirely new methods of construction which allow the building of large and small concrete vessels of remarkable elasticity and of comparatively light weight. In addition to this the cost of construction is greatly reduced—no forms being used—and as all concrete is handled, applied and finished by machinery, especially designed for this purpose, the risk of poor workmanship is almost completely eliminated.

The ship's hull consists of a strong framework of steel which is so designed that the combined strength and advantages of steel and concrete are fully recognized. This truss frame is erected and riveted in the ordinary manner. In the completed ship the steel frame is entirely encased in concrete and thereby protected against rusting. By this encasing the steel members are also stiffened and the "buckling" stresses are greatly reduced. For this reason the steel members of the frame are of simple design and relatively light weight.

After the steel frame is completed, the same is covered with a "multiple unit" wall construction (of the writer's design) of varying thickness. The walls are formed of a high grade concrete applied by compressed air and each section is independently reinforced by networks of light steel bars and wire mesh. All ship shells, bulkheads and decks are formed in a similar manner without the presence of any construction or connection joints, so that the completed ship is one seamless, monolithic structure.

The concrete is composed of Portland cement and crushed quartz or other suitable stone material. All pieces not passing a one-half inch screen are rejected. These materials with the necessary waterproofing medium and the water for proper hydration are mixed and ground together and before being placed are properly conditioned to reduce the danger of cracking due to excessive expansion and contraction.

The material, so prepared, is applied in even and uniform layers by means of a powerful stream of compressed air with a special machine named the "Tector," especially designed for this purpose. For the material combination thus described, the name "Torcrete" has been adopted. It is really a waterproof concrete of highest possible quality.

After the last coat of "Torcrete" has been sufficiently hardened, the outer surfaces are rubbed down to an even, smooth finish with rotary compressed air-driven grinders, and the entire ship may be painted as usual.

These, of course, are only the general outlines of future cement, or rather "Torcrete," ship construction. These methods can also be advantageously employed for reconstruction and repair of old steel ships and for placing of bulkheads, tanks and decks in old hulls.

The principal advantages of the Torcrete ship are its low cost and the rapidity with which such vessels can be built. However, even at a considerably higher price, its use would be of greatest value for cargoes which require even temperatures and which are destructive to steel. For tank barges, ore and coal boats, refrigerator ships and similar vessels, the advantages of a non-rusting ship will be quickly recognized.

CARL WEBER,
President Cement-Gun Construction Company.
Chicago, Ill.

Rolling of Ships and Methods of Damping it

BY ARTHUR R. LIDDELL

The subject of the rolling of ships admits of more comprehensive treatment than it has hitherto received. Speaking generally, a stable ship careened in some way in still water, and, suddenly released, will roll in a certain period of her own. Should she when at sea encounter waves having the same period as her own or one that is a multiple of it, rolling increasing in amplitude will ensue. On closer examination, however, the problem is found to be less simple.

With increasing amplitude of rolling the period of the ship may alter to an appreciable extent. For small angles of inclination it is given by the formula

$$T = .554\sqrt{\frac{k^2}{m}}$$

in which T is the period for a single roll in seconds, k is the radius of gyration in feet, and m the metacentric height (GM) in feet. The more general formula, however, is

$$T = .554\sqrt{\frac{k^2}{l \sin \alpha}}$$

in which l is the righting lever in feet and α the angle of heel in degrees.

Where the curve of righting levers coincides up to the extreme angle of roll with the tangent to it drawn from the origin, the general formula will give good results. But the curve may rise above or fall below the tangent, and on the degree to which this takes place the correctness of the result will in each case depend. At the angle at which the deck edge becomes immersed a considerable drop in the curve begins to set in. When this happens, or when in a seaway, the top of a wave crest comes on deck, a new factor is introduced. The water lodges behind the bulwark, or, in the case of an open rail, is slow in running off. Experiment has shown the damping effect of such an immersion of the deck edge to be very considerable. When it occurs the period of the ship is at once lengthened, and this produces a difference between the phases of ship and waves, which, though small to begin with, increases with every succeeding roll. Especially when the ship has a bulwark, the rolling gradually subsides till the two sets of impulses at work act in opposite directions. The water runs off the deck and the process begins again.

It is said that the heaviest rolling often takes place in a confused sea. A confused sea is not always so irregular as it at first sight appears. It may, in fact, consist of trains of waves set up by two or more winds that have been blowing in different directions in succession. Consider the case of two such trains, the one of 400-foot waves and the other of 500-foot waves, at an angle of 45 degrees with it, the latter considerably degraded from the original height. A vessel may find herself obliged to steam slowly against the high waves and, in accordance with good practice, at an angle with them. She may thereby find herself broadside on to the degraded waves, and it may also happen that, say, the half period of these latter synchronizes with her own, whereas the period or half period of the high waves due to the gale actually blowing does not. Again, the degraded waves may be

Generated on 2024-08-12 19:33 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

running at right angles to the shorter waves and the synchronism be just right for the course which the ship would have to choose on either tack. Or again, there may be three trains of waves running and the ship find it impossible to avoid synchronism with one or other of them.

She has the greater freedom of action in the case of a single train of waves where a slight change of course may bring her considerable relief. A single train of waves may itself appear irregular in so much as a few waves of extra height periodically occur in it. Dr. Vaughan Cornish has shown this to be the result of a gale moving in the same direction as a long ocean swell. The origin of the ocean swell is not quite clear, but it is an observed fact that low swells of very long period traverse the ocean, and the storm waves ride over their crests and troughs, giving the irregular appearance referred to. Their effect on the rolling of a vessel may be either to increase or to diminish it at certain points in the train, according as the crests of the swell happen to coincide with crests or with troughs of the storm waves.

In regard to length of wave, there are two critical conditions for any given ship. The one is that in which the length of the wave is the same as her own, when its crest rises highest on her side, and the other is that in which the periods of ship and waves coincide, as referred to above. But it may happen that these conditions occur together, so that waves of the ship's own length have a period the same as her own. When this is so, the efforts of successive waves to careen such a ship traveling over them are the greatest, since each one then exerts its maximum possible impulse. To build and stow a ship in such a way that the two critical conditions cannot occur simultaneously is possible, but both of them will still have to be provided against.

To meet the case in which the length of the ship is the same as that of the waves a sufficiency of freeboard must be provided, and that not only at mid-length of the ship, but all fore and aft. To prevent violent rolling, the resistance to the rolling motion at different angles of heel may be made to vary. Bilge keels effect this when one of a pair of these emerges from the water at a certain angle of inclination.

The general effect of bilge keels is to increase the resistance of the ship to rolling. Their presence reduces the amplitude of successive increases of roll, so that with successions of impulses of given strength a ship takes considerably longer to reach a given angle. At the same time it increases the period by a percentage which, though not large in itself, may attain importance by a series of repetitions. If a pair of bilge keels be arranged in such a manner that they are alternately rolled out of the water before the deck edge is immersed, the amplitude of the end portion of each roll is increased and its period is at the same time shortened. Provided a number of rolls be still needed before immersion of the deck edge takes place, the acceleration may be sufficient to damp the rolling and make it gradually die down for a while.

Should the deck edge of a ship become immersed, perhaps so that water comes on board and is caught behind a bulwark, an effect contrary to that of the emersion of a bilge keel is produced. The period of the ship's roll is lengthened, and this more and more the deeper the immersion and the greater the weight of water on deck. The synchronism is gradually destroyed and the rolling motion again dies down, ceases for a time, perhaps, and then gradually begins again.

Side fins arranged a little above the water line have a greater damping effect than bilge keels, but objection is made to them on the grounds that they increase the breadth of the ship and that they interfere with boats that have to come alongside.

Another method of damping rolling is that of the water-chamber containing so-called loose water with perhaps some valve arrangement controlling the flow from side to side of the ship. This is stated to be effective when the stability of the ship is considerable. When the stability is small such tanks are seldom used, even when they form part of the equipment of a ship. They may, indeed, become a source of danger in giving a ship a list. They take up room and are expensive. This is true in a still higher degree of the Schlick gyroscope, which, however, is less likely to become dangerous.

Rolling may be damped by any of these devices, but not pitching, and, although they may make life pleasanter for passengers, they will not entirely prevent *mal de mer*. But the relief of *mal de mer* is not their only object. They also help to keep the deck dry. Whether raftlike motion would justify a reduction of freeboard, and if so, what reduction, are very debatable points, but with the present official freeboards, ships that possessed it would be subject to far fewer casualties than the average ones on service to-day.

There are two classes of ships in which heavy rolling cannot come in question. These are the very broad Dutch logger and the monster passenger liner with moderate stability. By reason of her large proportion of breadth to depth, the logger's period is extremely short. The wave critical to her in this relation is so short, and therefore small, that it has practically no effect on her lateral motion. She may pitch like other vessels, and in this way be uneasy enough.

The monster liner has an actually greater, but in relation to her dimensions, much smaller GM-height than an average vessel of medium size. Her period, as measured by the formula

$$T = .554\sqrt{\frac{k^2}{m}}$$

is a very long one. A wave of the same period would be longer than the very longest of those likely to be encountered. These monster ships pitch very little, on the one hand because the waves that might be long enough to affect them are relatively low, and on the other, because the proportions borne by their lengths to their other dimensions are very large ones. Moreover, the long waves are the ones most seldom met with.

For the smaller ships, which we shall always have with us, the problem of damping rolling still remains to be solved. In view of the objections to fixed side projections, some kind of removable fin might be applied. The mechanical difficulties of fitting such fins, fitted, say, in short pieces so that they could be drawn inboard like centerboards or folded up against the ship's side, do not seem insuperable. They would be expensive, but their potentialities might be very considerable. A beamy ship that could be kept from rolling otherwise than with the waves would have advantages that would justify a good deal of outlay of the kind contemplated. People on board would feel little lateral motion and the deck would be comparatively free from floodings. Cargo shifting would be unknown and sailors and firemen would work under ideal conditions. Then, again, the moment of resistance of a ship to longitudinal bending diminishes considerably when she is careened over, and if a non-rolling ship could not be let off with comparatively light scantling, she would at least keep the sea longer without need of repair.

The damping devices above referred to are not the only possibilities. Side tanks just above the waterline that would admit water readily through apertures and part with it slowly would increase the radius of gyration and perhaps raise the center of gravity of the ship when she rolled, thus increasing k^2 and reducing m in the formula,

Generated on 2024-08-12 20:11 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

and also lengthening the period. When the rolling ceased the water would run out again.

The prevention of rolling seems to offer a promising field for the inventor and one in which success may bring high reward. It may be observed that the rolling of certain warships was unintentionally damped by the fitting of the side armor plating so that it projected at its foot beyond the curved surface of the side. Reduction of rolling has also been claimed for a certain line of steamers, which, on account of wharf conditions were each fitted with two pairs of bulky fenders, viz., one pair at about deck height and the other some feet below it. In both these cases the good effect was produced by alteration of the period by means of side projections rolled into or out of the water. But, without the use of mechanical devices, much can be done in the fixing of the dimensions of a ship to avoid excessive rolling.

It is generally assumed that calculations of the vertical position of the center of gravity entail an enormous amount of work. This is perhaps true for a war vessel or where there are very many considerable weights the distribution of which may vary. But a large part of the hull of a plain merchant ship has its stereotyped position in every design. Boilers, engines, cables and such like larger parts of the whole can each be treated separately in the final calculation. In themselves these are either fairly regular constructions with known positions of center of gravity or they can be represented by plain figures easily dealt with. Small weights can either be grouped or neglected. The possible percentage of effect on the whole must in each case be kept in view.

Of more importance and sometimes a matter of great difficulty is the cargo. A homogeneous cargo filling the holds may be taken account of with relative ease as a whole. When heavy cargoes are in heaps in the different holds the figure and position of each heap must be known. A table of the centers of gravity and moments of inertia of a variety of plain solids will here be found useful. In the case of general cargo a knowledge of the habits of stevedores and of the possibilities of discharge of goods and taking in of others at intermediate ports on a voyage becomes necessary.

Throughout the calculations it is necessary to think in terms of percentages of moment of inertia or the equivalents of these. Exact results will never be attained, but something less than exactness will suffice. If the result be, say, 4 percent out, the period is altered by only $\sqrt{4}$ percent. But a difference of 2 percent on the period counts for very little in considering the tendency of a ship to roll heavily, although it may be important when waves of a given period are in question. If rolling be set up by mechanical means in still water, the period thereby measured may, when the moment of inertia or the radius of gyration is known, be used to determine the GM-height or m. The general equation

$$T = .554\sqrt{\frac{k^2}{m}}$$

may be written in the form

$$m = .307\left(\frac{k}{T}\right)^2$$

Some attention has recently been given to the question of determining a merchant vessel's stability before she leaves port. In theory this may be done by the aid of the last-mentioned equation, provided an approximate estimate of her radius of gyration has been made and her period can be determined by causing her to roll. Unfortunately, no sufficiently convenient means of careening and releasing her again is available. The expedient of men running from side to side on deck can seldom be applied, and if a mechanical device were invented the ship could still not always be released from her moorings to apply it.

Methods have been elaborated for measuring a ship's period while she is rolling at sea and determining her most advantageous GM-height therefrom. If the necessary observations be conscientiously carried out this may give important results. It will indicate to the men who work the ship the stowage of different cargoes and enable them to make more definite reports than has hitherto been possible of the prevailing conditions, so that in the design of later vessels for a given service better advantage may be taken of their experience.

Until a satisfactory method of preventing it has been discovered and applied, rolling may, under given conditions of the sea, be expected to occur in the case of every ship of ordinary size and design. Excessive rolling resulting from excessive stability may be avoided, first, by attention to lessons of experience entailing a not very formidable calculation of the designs of vessels, and second, by reasonable stowage. The practice of some stevedores of taking the cargo as it comes and disclaiming responsibility for consequences must be confined within the limits which a better understanding of cause and effect will some day enable us to define.

Increased Duties of the Steamboat Inspection Service

The urgent need of an increased force of inspectors in the United States Steamboat Inspection Service is emphasized in the annual report of the supervising inspector-general of this service. In the estimates for the fiscal year ending June 30, 1917, Congress provided for thirty-one additional inspectors. This increase of force was most urgently needed, in order that the inspectors could properly perform the duties that are required of them. The time had come when it was useless for Congress to pass any more laws referring to safety on board ship or for the Board of Supervising Inspectors to make further regulations in regard to the subject until a sufficiently large number of men was furnished to enforce the provisions of the laws and the rules and regulations that already existed. Large as the increase was in the number of inspectors, a sufficient number has not yet been furnished, and it is necessary that a material increase be made in the number of inspectors in the near future, in order satisfactorily to carry on the work of the service.

The work of the service has increased immensely as a result of admittance to American registry of many foreign-built ships, and as the time approaches when these vessels will be subject to the same inspection as American-built ships, it can be appreciated that with the large number of large vessels that have been admitted to American registry the inspectors of this service on the coasts will be most busily occupied in examining these vessels preparatory to the issuance of certificates of inspection.

The supervising inspector general also calls attention to the need of a scientific and careful revision of the laws that relate to shipping. This revision, however, should be undertaken only by persons thoroughly familiar with the conditions. For a person to attempt to revise the laws that relate to shipping in a period of one or two months is, on its face, absurd, and for one person to undertake it is the height of absurdity. As to why the officers responsible for the enforcement of the law have not undertaken a revision of the laws long ago, the supervising inspector general states that the answer to that question can be found in the fact that the duties of these officers are so arduous that they have simply not had the time to undertake such a task.

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

UNITED STATES SUPERDREADNOUGHT PENNSYLVANIA

Built by the Newport News Shipbuilding & Dry Dock Company

(Copyright, E. Muller, Jr., New York)

U. S. S. *Pennsylvania* Steaming Up East River to Navy Yard, New York.

The *Pennsylvania* went into commission on June 12, 1916. She has a normal displacement of 31,400 tons and an overall length of 625 feet. On trial she averaged a speed of 21.05 knots. Propulsion is by four screws actuated by Curtis turbines. The main armament consists of twelve 14-inch guns arranged in four turrets.

Generated on 2024-08-12 19:55 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

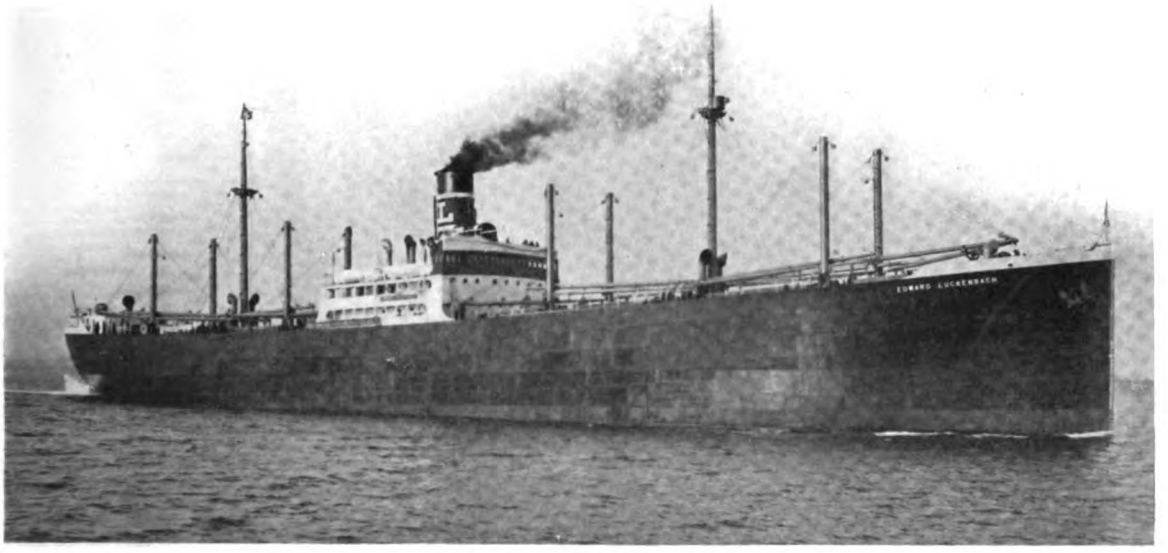


Fig. 1.—S. S. *Edward Luckenbach*

Freight Steamer Edward Luckenbach

First of Five Sister Ships Building at Fore River Shipyard for Luckenbach Steamship Company—Propulsion by Geared Turbines

A NOTABLE addition to the fast growing mercantile fleet of the United States has recently been made in the delivery of the freight steamer *Edward Luckenbach*. This vessel, the first of five now under construction for the Luckenbach Steamship Company, of New York and San Francisco, by the Fore River Shipbuilding Corporation, of Quincy, Mass., represents the highest type of general freight vessel and in its design and construction reflects credit on both builders and owners. For the following details we are indebted to Mr. E. C. Bennett, naval architect of the Fore River Shipbuilding Corporation.

The *Edward Luckenbach* was designed to the owners' special requirements for coast-to-coast and overseas trade, and in the adoption of a modified cruiser stern a novel arrangement of bridge and deck house bulwarks, with two masts and eight king posts and one large smokestack, inaugurates for the Luckenbach Steamship Company a handsome vessel of individuality and distinctive appearance.

As will be seen from the accompanying plans and photographs, this vessel is of the shelter deck type with large cargo hatches, wide-spaced hold stanchions, wide-spaced frames and no side stringers. She has been constructed under the special survey and to meet the full requirements for hull, equipment and machinery for both the American Bureau of Shipping and Lloyds Register of

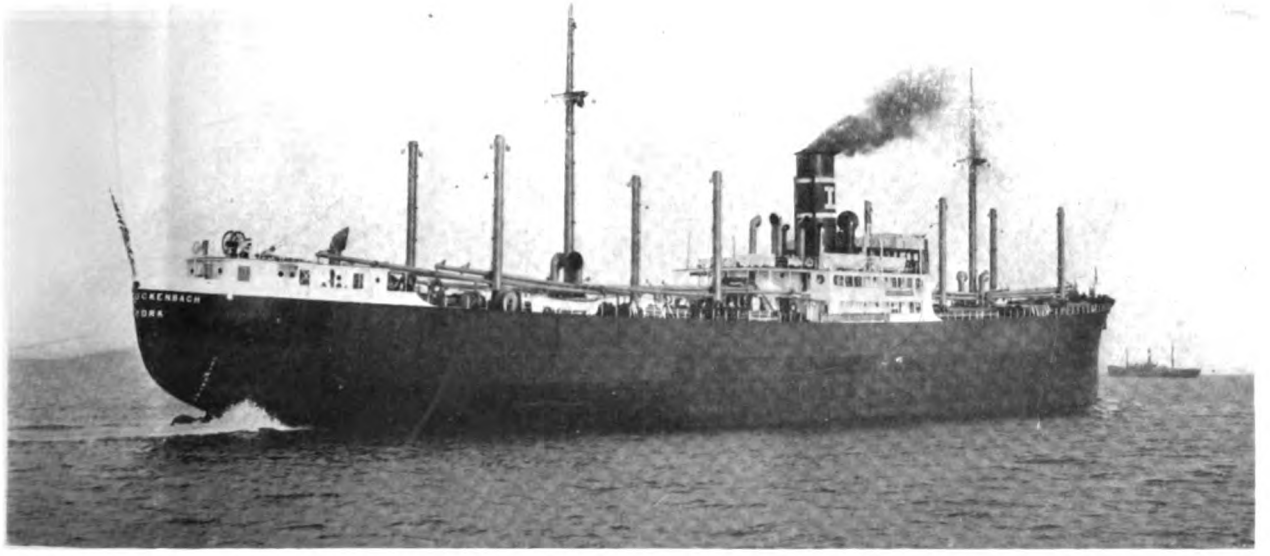


Fig. 2.—View of the *Edward Luckenbach* Showing Cruiser Stern

Generated on 2024-08-12 19:49 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

GEARED-TURBINE FREIGHT STEAMER EDWARD LUCKENBACH

Built by Fore River Shipbuilding Corporation

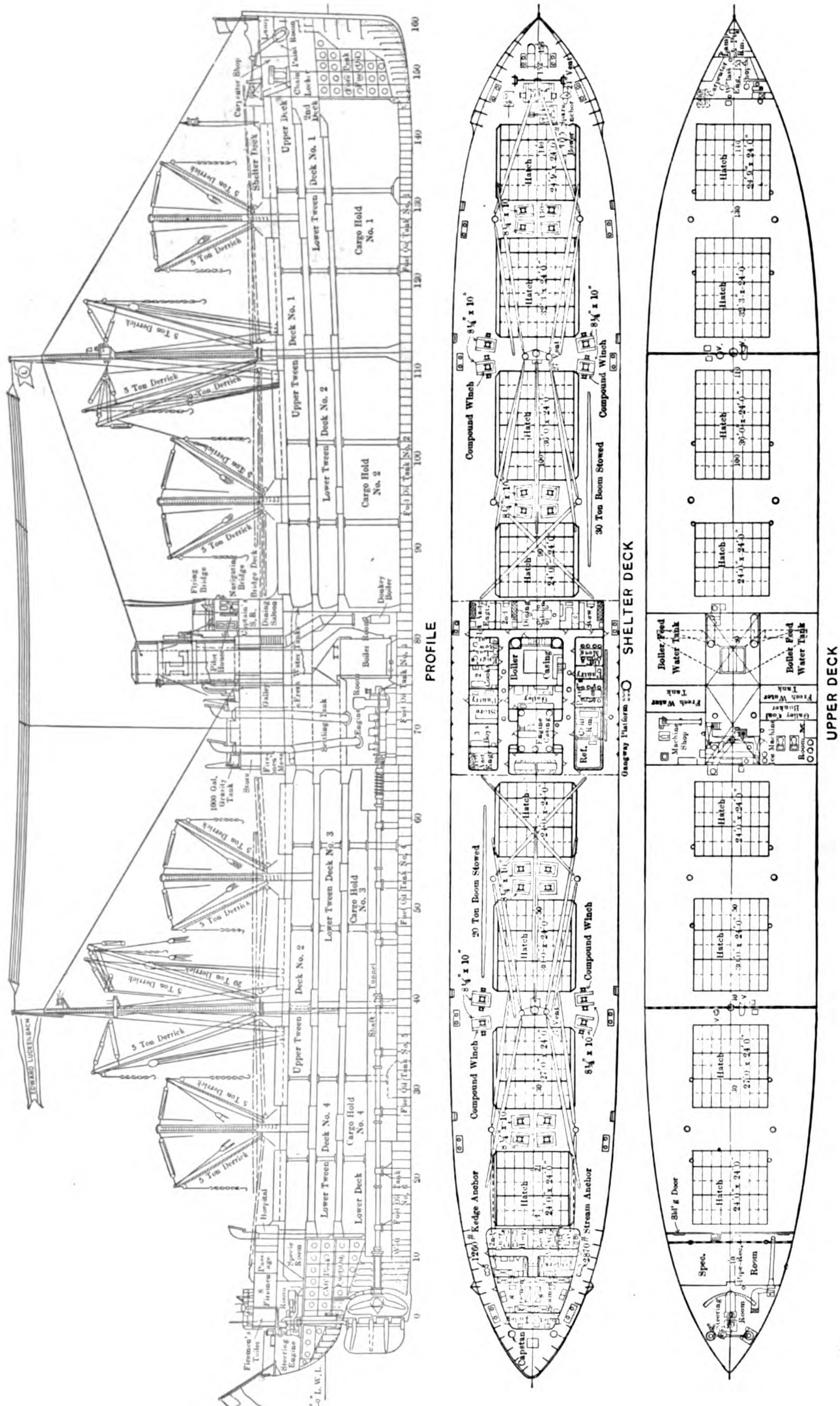


Fig. 3.—Profile and Deck Plans

Generated on 2024-08-12 19:33 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from UNIVERSITY OF MICHIGAN

FREIGHT STEAMER EDWARD LUCKENBACH

Built by Fore River Shipbuilding Corporation

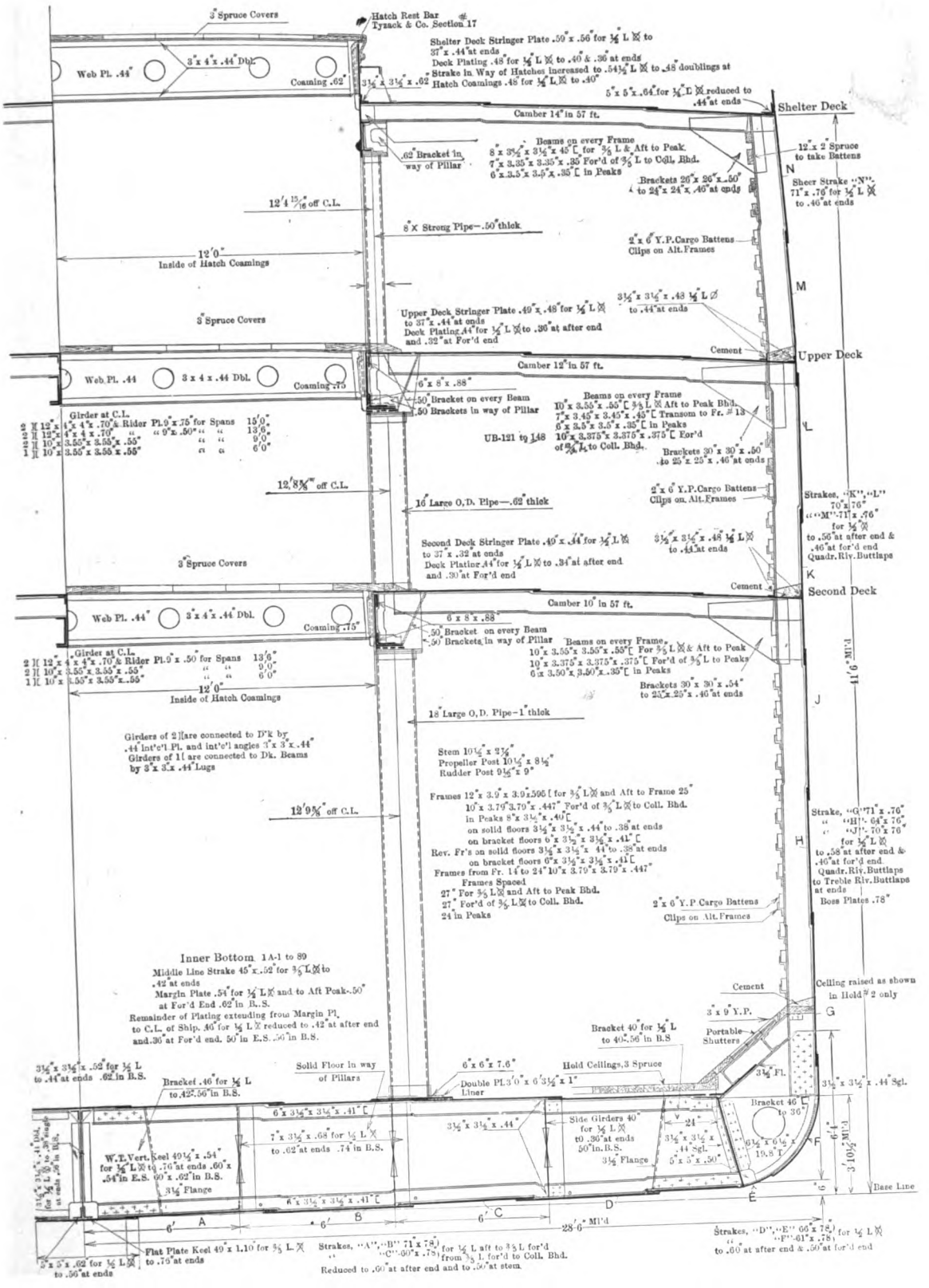
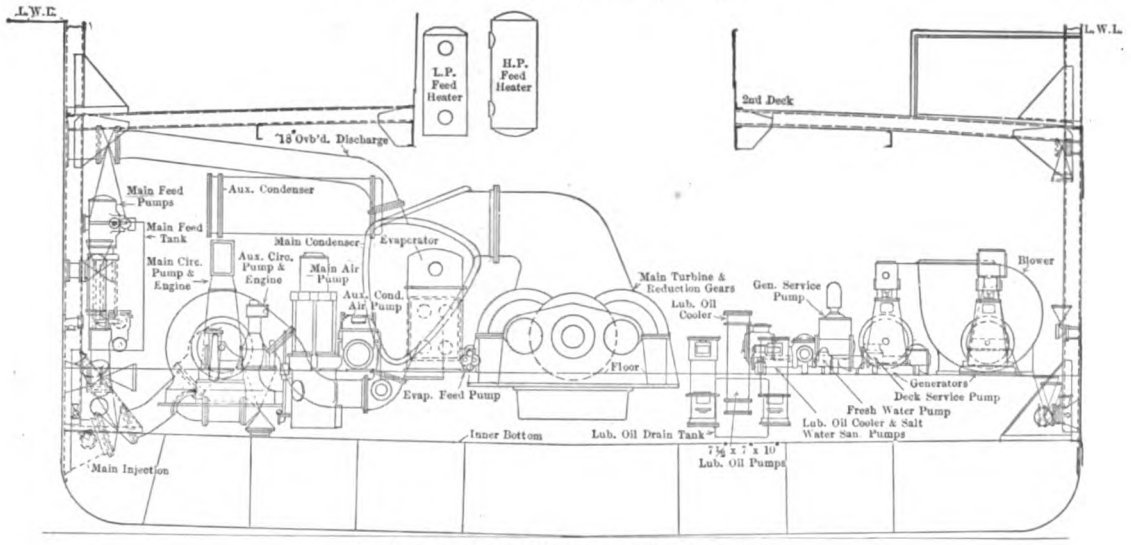


Fig. 4.—Midship Section, Showing Scantlings

Generated on 2024-08-12 19:33 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

FREIGHT STEAMER EDWARD LUCKENBACH

Built by Fore River Shipbuilding Corporation



CROSS SECTION FRAME NO. 66 LOOKING FOR'D.

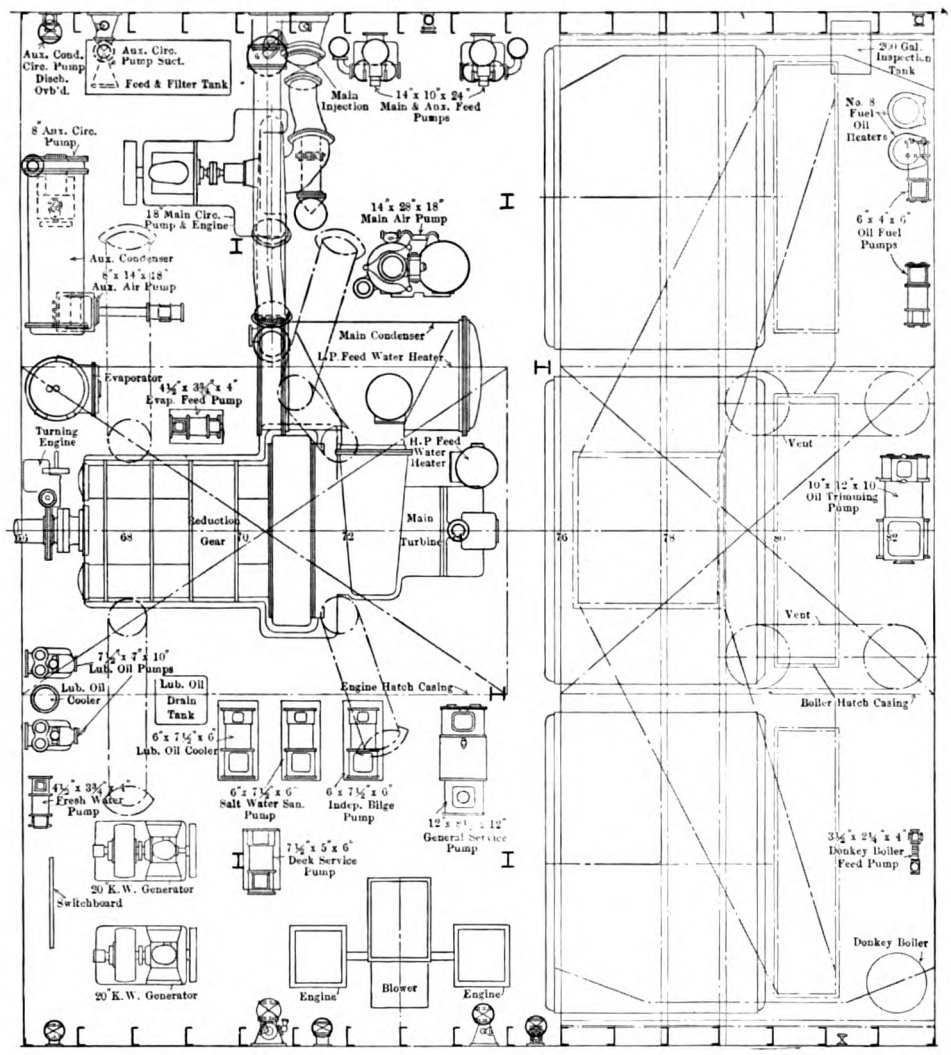


Fig. 5.—Machinery Arrangement

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Shipping, to obtain the highest classification ratings with freeboard assignment, in the records of both societies.

The *Edward Luckenbach* is of the following dimensions:

Length overall	456 feet 5 inches
Length from forward side of stem to after side of rudder post	437 feet 6 inches
Breadth molded	57 feet
Depth molded to shelter deck at side	41 feet 6 inches
Gross tonnage	8,151
Net tonnage	6,141
Panama Canal gross tonnage	8,543
Panama Canal net tonnage	6,426
Load draft	31 feet 8 inches
Deadweight, tons	12,250
Height between shelter and upper decks	9 feet 6 inches
Height between upper and second decks	9 feet
Fuel oil capacity, tons	2,131
Capacity of cargo holds, cubic feet	584,270

There are three continuous steel decks running the full length of vessel, named shelter, upper and second, respectively. The second deck beams are in excess of the classification societies' requirements, and with a 'tween deck height of 9 feet 6 inches this vessel readily adapts itself for use as a transport or for carrying cattle.

The double bottoms are constructed on the alternating solid and bracketed floor principle, and with the forward and after peak tanks are arranged for the stowage of fuel oil. The fuel oil settling tanks and the fresh and boiler feed water tanks are located in the 'tween deck spaces outboard of the machinery casings.

The arrangement of masts, king posts and deck winches has been made with a view to the rapid handling of general freight. The foremast has one 30-ton and four 5-ton booms, the mainmast one 20-ton and four 5-ton booms, and each of the eight king posts has two 5-ton booms. The deck winches, constructed by the Hyde Windlass Company to the special requirements of the owners, are twenty-four in number, twenty being single-geared and four compound-geared, all with cylinders 8¼ by 10 inches.

The steering machinery, also furnished by the Hyde Windlass Company, is of the Brown steam tiller type with cylinders 9 inches by 12 inches, and operated by telemotor from the pilot house and flying bridge and by shafting from double wheel hand gear stand on top of after deck house.

The windlass and after warping capstan were supplied by the American Engineering Company, the former being of the worm drive type, having the windlass on shelter deck and a double 14-inch by 12-inch cylinder inverted engine on deck below. It is the No. 12 size and arranged to take 2⅜-inch stud link chain. The warping capstan engine, having 8-inch by 10-inch double cylinders, is located in the steering engine room and operates two 19-inch diameter gypsy heads on the shelter deck.

Special attention has been given to the ventilation of cargo holds, each hold and 'tween deck cargo space having a natural supply of air through cowl ventilators and a mechanical exhaust by four Sturtevant electric driven exhaust fans, each having a rated capacity of 6,000 cubic feet of air per minute. These fans are located in the fore peak boiler room, engine room and steering engine room and exhaust to the atmosphere.

In view of the long voyages the *Edward Luckenbach* will travel, the comfort and habitability of the officers' and crew's quarters were given special consideration by the owners. The navigating bridge is entirely enclosed, thus insuring comfort to the officers on watch in all weathers. The interior of this enclosed bridge, together with the dining saloon, captain's suite, and owner's stateroom, are attractively paneled in white enamel and mahoganized birch. The rooms for the senior and junior officers are commodious and well arranged. Each is furnished with ample locker and drawer space and with upholstered settees. The crew and firemen are berthed in the after deck house in large rooms, and they also are well equipped with individual metal lockers and drawers below the berths.

The propelling machinery is located amidships and consists of a Curtis turbine driving the propeller shaft through a double reduction gear at a designed normal speed to deliver 4,000 shaft horsepower at 90 revolutions of the propeller shaft. The turbine is fitted with overload nozzles, so that the machinery will develop 4,500 shaft

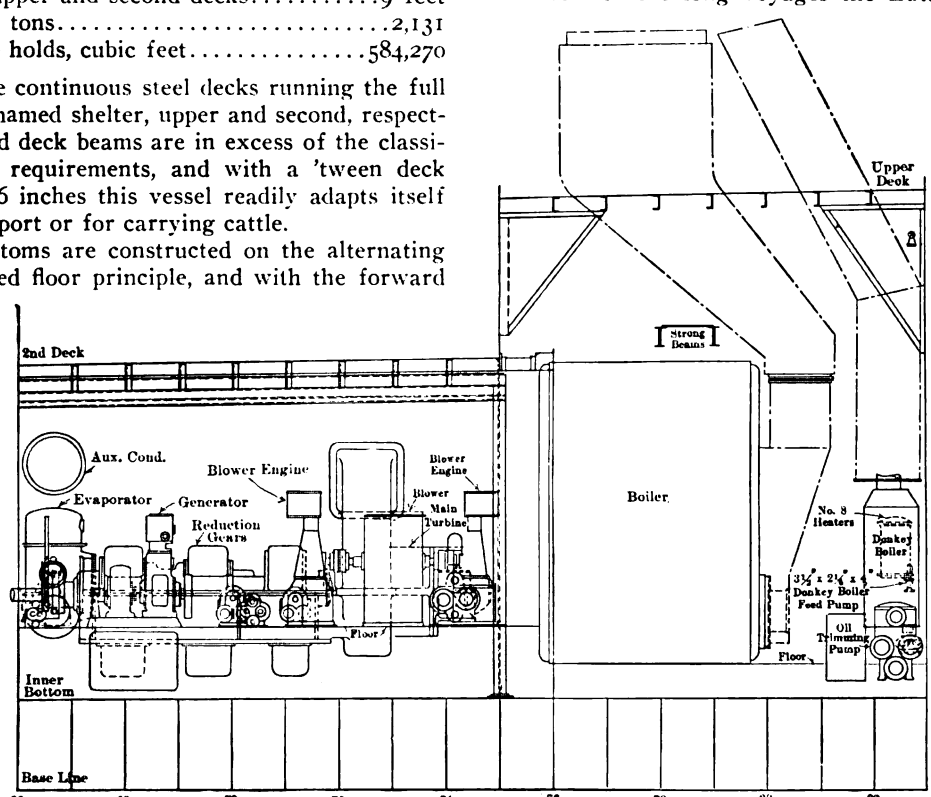


Fig. 6.—Longitudinal Section Through Machinery Space

Generated on 2024-08-12 19:51 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

TABLE 1—ENGINE ROOM

PERIOD.	PRESSURES, LBS. GAGE.			Vacuum.	BEARINGS.		TEMPERATURE, DEGREES F.		
	Main Steam.	Steam Chest.	Oil.		Forward.	Aft.	Injection.	Discharge.	Room.
12:00 to 12:30	176.8	137.3	8.8	28.75	103.5	85.5	44.	69.	74.
12:30 to 1:30	179.4	159.3	12.0	28.75	103.3	98.	45.	64.7	75.
1:30 to 2:30	191.0	176.1	17.0	28.75	103.0	117.7	45.	66.3	79.
2:30 to 3:00	194.0	179.0	17.0	28.90	102.0	116.5	43.5	65.0	78.5
Overload	195.0	170.0	28.75						

TABLE 2—FIRE ROOM

PERIOD.	PRESSURES, LBS. GAGE.			Fuel Oil At Burners.	TEMPERATURES, DEGREES F.			Air Press, Inches.
	MAIN STEAM AT BOILERS.				FUEL OIL HEATER.			
	Starboard.	Center.	Port.		Inlet.	Outlet.	Room.	
12:00 to 12:30	185.5	182.8	183.5	121.7	103.7	247.8 248.2	96.7	.9
12:30 to 1:30	182.1	179.3	179.9	146.4	104.6	28.2	92.9	.87
1:30 to 2:30	192.4	189.2	189.4	165.7	99.3	253.6	88.9	.93
2:30 to 3:00	196.	192.5	192.5	158.8	97.5	254.0	86.0	.98

TABLE 3—TRIAL TRIP DATA

TIME.	REVOLUTIONS.			S. H. P.		FUEL OIL.			WATER TURB. ONLY.	
	Counter Reading.	Period.	R. P. M. Period.	T. Meter. Read. 4834	Period.	Meter Read.	Lb. Per Hr.	Lbs. Per S. H. P.	Lbs. Per Hr. Period.	Wate Rate Period.
12:00	125,436	....	....	70	....	900	....	....	....	....
12:10	126,282	846	84.6	78	3,190	967	....	....	....	....
12:20	127,135	853	85.3	76	3,140	1,075	....	....	....	....
12:30	127,999	864	86.4	81.5	3,400	1,114	....	....	....	....
Average.....			85.4		3,265		3,200	980	39,700	12.17
12:40	128,876	877	87.7	85.0	3,600	1,178	....	....	....	....
12:50	129,764	888	88.8	85.5	3,670	1,268	....	....	....	....
1:00	130,658	894	89.4	89.5	3,865	1,362	....	....	....	....
1:10	131,547	889	88.9	86.5	3,715	1,422	....	....	....	....
1:20	132,440	893	89.3	88.5	3,820	1,522	....	....	....	....
1:30	133,346	906	90.6	89.5	3,920	1,610	....	....	....	....
Average.....	....	..	89.1	....	3,787	....	3,710	980	42,600	11.24
1:40	134,261	915	91.5	90.0	3,980	1,715	....	....	....	....
1:50	135,189	928	92.8	94.0	4,210	1,812	....	....	....	....
2:00	136,122	933	93.3	94.0	4,235	1,902	....	....	....	....
2:10	137,055	933	93.3	95.0	4,280	1,986	....	....	....	....
2:20	137,986	931	93.1	94.0	4,230	2,065	....	....	....	....
2:30	138,916	930	93.0	92.5	4,150	2,173	....	....	....	....
Average....			92.8		4,181		4,210	1,007	46,650	11.17
MEASURING WATER FOR ALL PURPOSES										
2:30	138,916	....	....	....	....	2,173	....	....	....	....
2:40	139,844	928	92.8	96	4,300	2,254	....	....	....	....
2:50	140,773	929	92.9	96	4,310	2,352	....	....	....	....
3:00	141,702	929	92.9	97	4,350	2,450	....	....	....	....
Average....			92.9		4,320		4,140	960	54,800	12.67
Overload....			98	110.5	5,230	With 2 overload nozzle valves open.				

Draft = 10′ 4½″ forward, 18′ 9″ aft.
Speed by log 14 knots.
Fuel oil 18,170 B. T. U. per lb.
0.894 Sp. Gr. at 60° F.
Displacement = 7,300 tons.

horsepower with a propeller speed of 93 revolutions per minute. The turbine is designed to operate with a steam pressure of 190 pounds in the steam chest and against a vacuum of 28½ inches, with the astern turbine capable of delivering to the shaft about 50 percent of the power of the ahead turbine. The rotor is so arranged that the ahead and reverse wheels are carried on one shaft and operate in the same casing, the main exhaust being common to the ahead and reverse. The turbine is very substantially built of high grade steel, the blading being of Monel metal of heavy proportions, and the revolving element is designed so that it can easily stand an over-speed of 20 percent above the full speed revolutions.

The total reduction of speed between the turbine and propeller shaft is 37 to 1. The reduction is taken in two steps, the system employed being what is known as the double-drive type—that is, the pinion connected with the turbine engages with two gears, one diametrically opposite the other, thereby eliminating pressure on the pinion bearings and insuring perfect tooth contact between the pinion and the wheels. Each of the two wheels is coupled to a pinion, which in turn drive the main gear coupled to the propeller shaft. The high speed pinion is directly connected to the turbine shaft by means of a flexible coupling so arranged that any motion in the gears or pinions will not be transmitted to the turbine shafts.

The gears are double helical and are arranged in one plane, so that bearings and wheels can be easily exam-

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

ined and all parts readily kept in alinement. The turbines and gears were built by the General Electric Company, the gears being of the laminated type manufactured under the Alquist patents.

The propeller is 19 feet in diameter, with the blades set at a pitch of 16 feet. The pitch, however, is adjustable from 15 feet to 17 feet. The propeller blades are of manganese bronze and the hub of cast iron fitted to the propeller shaft with a taper key and held by a forged steel nut.

Steam is supplied by three Scotch boilers, each 16 feet 6 inches inside diameter, and 12 feet 3 inches long over the heads, with a heating surface of 3,546 square feet, each boiler having four Morison corrugated furnaces, 42 inches inside diameter. The boilers are designed for a pressure of 195 pounds per square inch and work under the heated system of forced draft, for which one Sturtevant multivane blower fan with two engines is located in the engine room. The boilers are arranged to burn fuel oil on the Dahl system, the necessary pumps, filters, heaters, etc., being arranged in the fireroom.

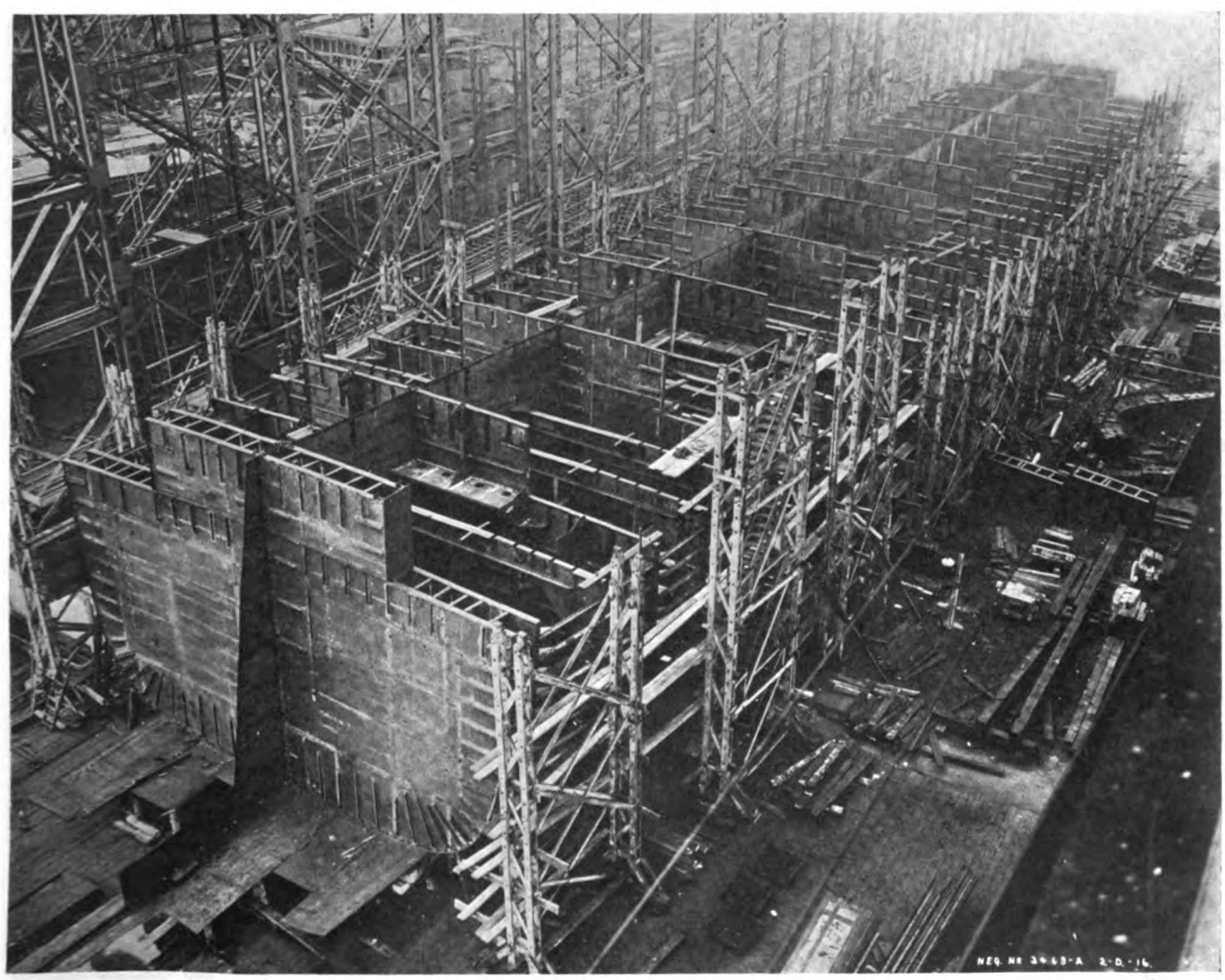
The main condenser of special construction for turbine work is placed on the port side of the engine, having a cooling surface of 5,850 square feet. The air pump, furnished by Blake & Knowles, is one of the independent wet and dry twinplex beam type, the necessary cooling water being supplied by the main centrifugal pump, having an 18-inch suction and discharge and driven by a 10-inch by 9-inch single cylinder vertical engine of the enclosed type and supplied with forced lubrication.

The necessary pumps, which are of the Blake & Knowles type, the high and low feed water heaters of Griscom-Spencer make, and an auxiliary condenser are located conveniently in the engine room. Abaft of the reduction gear is the thrust bearing, consisting of ten horseshoes with ample wearing surface. The line shafting consists of seven sections with the necessary bearings.

Fig. 5 shows the general arrangement of machinery in the ship, and it will be noted that the turbine and reduction gear type of engine leaves ample room for handling.

The electric plant consists of two 20-kilowatt General Electric generator sets driven by reciprocating engines. There is a 2-ton Brunswick refrigerating machine and a Griscom-Spencer evaporating machine of 35 tons capacity.

The *Edward Luckenbach* was taken on trial on November 28, the ship being in light condition, with measuring tanks and pumps installed so that the water measured by the main turbines alone, and the turbines and auxiliaries combined could be carefully ascertained. A torsion meter was fitted on the propeller shaft, the shaft having been calibrated together with the torsion meter before being installed on board. The oil used on the trial was heavy Mexican, which on test showed only 18,170 B. T. U.'s.



Record Work in Ship Erection

Contract 173 at yards of New York Shipbuilding Company, Camden, N. J. Keel laid November 1, 1916. 1,475 tons erected on December 1, 1916.

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

The whole of the machinery operated very satisfactorily, and after anchoring at Boston harbor for a couple of hours the vessel proceeded to New York, the trip from Boston to New York occupying about twenty-two hours.

The accompanying tables give data taken on the trial trip. The results are considered very satisfactory, as, at the normal designed rate of operating, the water rate of the turbines was only 11.2 pounds per shaft horsepower and the water rate of the turbines and auxiliary machinery was but 12.67 pounds per shaft horsepower of the main engines. The tables giving engine room, fire room and trial trip data will be found on page 12.

Motor House-Boat Vagabondia

Shallow Draft, Tunnel Stern House-Boat Designed by Cox & Stevens for Pittsburg Millionaire

THE motor house boat *Vagabondia*, designed by Cox & Stevens, naval architects, New York, for Mr. W. L. Mellon, of Pittsburg, Pa., and built by the Gas Engine & Power Company and Chas. L. Seabury & Company, Cons., of Morris Heights, N. Y., was completed early in October and is now in the South making ready to receive Mr. Mellon and his guests, who will spend the winter on the vessel. *Vagabondia* is the second vessel of the same name which Mr. Mellon has owned, and the general arrangement of the new boat has been carefully developed as a result of the owner's experience with the older vessel in Florida waters.

The dimensions of *Vagabondia* are:

Length over all	130 feet
Beam	23 feet 6 inches
Draft	3 feet 0 inches

In type, this vessel is similar to Southern river steamers designed to run in extremely shallow water, the tunnel construction being used aft to give clearance for the propellers, which is made necessary by the extremely shallow draft.

The hull proper of the boat is not used for living quarters except a small portion forward, where a few of the crew are housed, the balance of the hull, outside of the machinery space, being used for water tanks and storerooms.

A very unusual feature of the boat is the fact that the main deck, on which the owner's accommodations are generally placed, is in this boat really a working deck, being given up to the necessary quarters for the crew, and there being on this deck a large amount of deck space for stowage and handling of a large number of small fishing and ducking boats with their accompanying gear.

The upper deck, which extends from stem to stern, is the owner's living deck, and on it are placed all the accommodations for himself and guests. As will be seen from the photographs, *Vagabondia* presents a pleasing and workmanlike appearance, and an inspection of her plans shows that she has every quality necessary for comfort in the waters where she will be used, all the rooms being large, airy and comfortably furnished.

The hull of *Vagabondia* is of wood, and, although the draft is unusually light, the hull itself is constructed heavily in order to take care of the frequent grounding which a vessel of this sort must contend with. In order to secure the necesary rigidity of hull, not only are the wooden scantlings very heavy, but considerable galvanized steel has been worked into the construction to give added stiffness.

The main deck beams are of galvanized steel, and a galvanized steel shear strake and deck stringer is worked at the main deck connected by galvanized steel brackets to the deck beams. In addition, on each side of the centerline at about one half beam there is, fore and aft, a steel truss of lattice girder construction running the full length of the vessel, built up of galvanized steel angle bars and plates, which girders practically convert the hull of the vessel into a strong and rigid beam.

The machinery consists of two 150-horsepower, 6-cylinder Winton motors placed practically amidships. The gasoline (petrol) is carried on the main deck aft in a

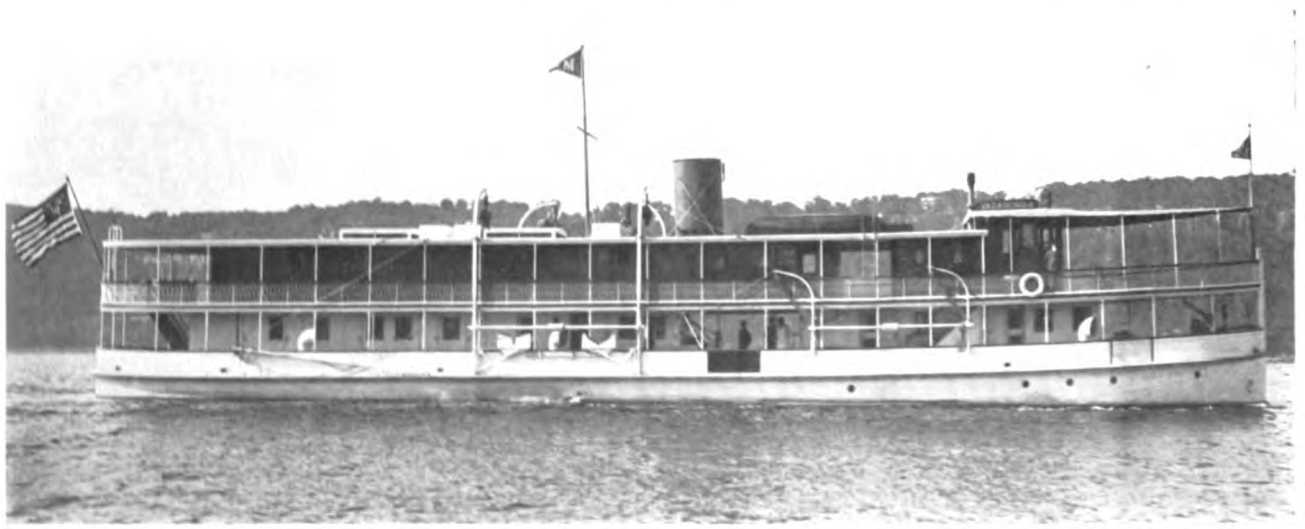


Fig. 1.—House-Boat *Vagabondia*, Propelled by Two 150-Horsepower Winton Six-Cylinder Engines

Generated on 2024-08-12 19:31 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

MOTOR HOUSE-BOAT VAGABONDIA

Designed by Cox & Stevens, New York

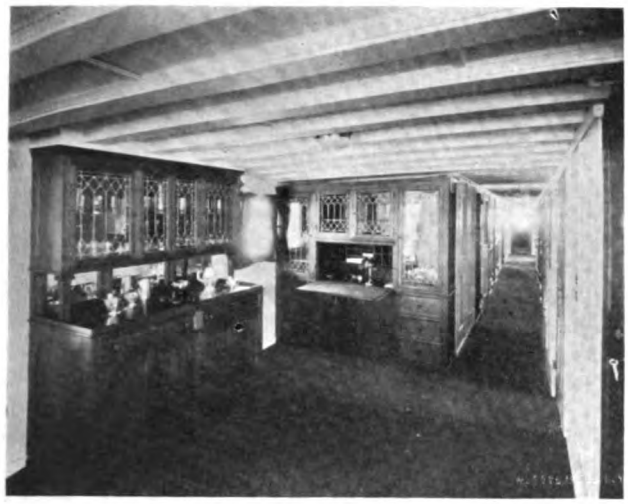


Fig. 2.—Living Room and Hall

Fig. 3.—Dining Room

Fig. 4.—Bath Room

Fig. 5.—Guests' Stateroom

Fig. 6.—Galley

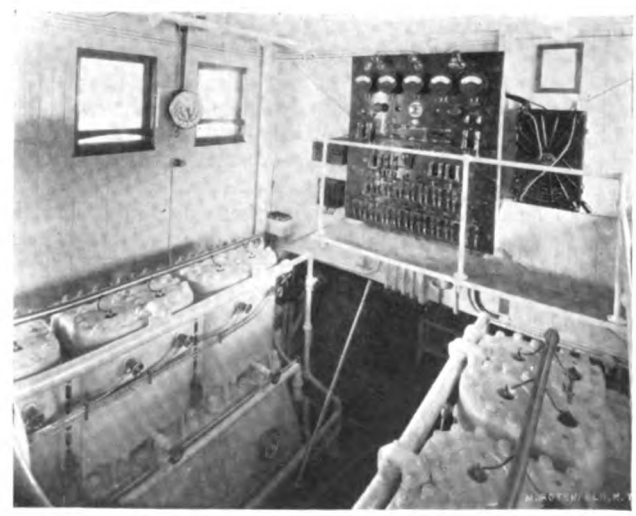


Fig. 7.—Engine Room

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

heavily constructed steel tank of 2,500 gallons capacity. Utmost care has been taken in connection with the gasoline (petrol) supply so that the danger from fire is practically eliminated.

The water tanks, of which there are four of 6,000 gallons capacity, are placed in the hold forward of the machinery space. Aft of the machinery space in the hold on the port side is a large fish well where bait and fish may be kept alive.

On the main deck are two deck houses, the forward one containing the mess room, in which is placed a hot-water heating boiler, and forward of this the galley and a room for dry stores. At the after end of this house is a large refrigerator with 7,000 pounds capacity, and at the forward end of the house another refrigerator for carrying fish.

The after house, which contains at the forward end entrance to the engine room, also contains a large storeroom for ship's stores, a pantry, a shower bath and bathing suit room, a drying room, captain's room, engineer's room, four other staterooms for officers, fishing guides, etc., and the necessary toilet rooms.

On the upper deck, which, as already stated, is the owner's living deck, there are also two houses. The forward house comains at the after end a smoking room, forward of which is a pilot house, from which the vessel is navigated.

The after house contains at the forward end a large living room and dining room combined, from which a central hall runs through this house, at the after end of which is a sitting room opening on the after deck. On the port side of this passage are three very large owner's rooms and one bath room, while on the starboard side are two other guests' rooms and additional bath room; also a pantry with large refrigerator and a room for stowing clothes.

The houses on the main deck are painted white, while those on the upper deck are of mahogany varnished. The general scheme of finish in the interior of the owner's and guests' quarters is simple paneling painted white, the furniture being of hard wood of a soft, brown tint. The upholstery and general furnishings have been carefully selected and the interior effect is very pleasing, as well as comfortable.

Vagabondia has a very complete outfit of auxiliaries, including large dynamos, ample storage battery capacity, electric windlass, air compressors, bilge, fire pumps, etc.

On trial, *Vagabondia* made better than 10 miles an hour, and she was found to handle in a very satisfactory manner.

Military and Technical Considerations of Battleship Design*

Large Battleships Advocated—Minimum Dimensions: Length, 640 Feet; Beam, 96 Feet; Draft, 30 Feet; Approximate Displacement, 36,000 Tons

BY NAVAL CONSTRUCTOR R. D. GATEWOOD, U. S. N.

THE whole history of warship design has been a long series of steps toward increased displacement, and, except for our own battleships *Idaho* and *Mississippi* and one or two classic examples abroad, there have been thus far practically no backward steps. Always an inevitable law of growth has asserted itself, and each successive vessel of every class has been larger than its predecessors.

In the case of battleships the tendency toward greater displacement would have been even greater were it not for two very important and practical objections:

1. The extreme reluctancy on the part of governments to spend such large and always increasing sums on single units of power.

2. The great difficulties in providing docking and harbor accommodations for vessels of the giant size demanded by those responsible for using these vessels in battle.

Means have been devised, as, doubtless, means will continue to be devised, to overcome these objections, but is there not a limit to this increase in dimensions? If so, what are the governing considerations that are likely to determine this limit? What are the minimum dimensions of the ship that will best meet our needs?

These dimensions are influenced and determined by four factors:

1. Our national policies. 2. Considerations of strategy and tactics. 3. Techincal limitations. 4. Cost.

Let us cast aside all preconceived ideas as to size and analyze with an open mind the influences of each of these governing factors on the military and technical characteristics of battleship design. From the facts developed by this analysis, let us then try to arrive at our minimum dimensions, bearing in mind always that the design thus determined merely gives "expression to the technical ideas and intentions of the epoch."

Policy and Ship Design

Fundamental questions affecting a state's welfare, comfort, and sometimes its very existence—questions that are the living embodiment of the will of its people—are called its policies. We have gradually accumulated a set of policies giving us contact with many other states along virtual frontiers approached in extent by those of England alone. By virtue of certain geographical, racial and economical conditions over which we have no appreciable control, these policies now conflict, and will continue to conflict, with the vital interests of various other world states. In the analysis of the relative seriousness of these conflicts the statesman should reason out which state is likely to be our most probable opponent, and then should adopt a definite naval building programme against that state. Our Congress has never done this, and yet the development of our fleet, if it is to uphold these policies, must be absolutely linked up with them.

Lacking a well-defined foreign policy, it was not until some time after the advent of the new steel navy that the United States made any material progress in the design of new types. At first, due to this lack of a definite policy to direct our efforts, we took one or two backward steps.

* Paper read before the Society of Naval Architects and Marine Engineers, New York, November, 1916.

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

As a natural consequence of "political drifting," we proceeded to copy foreign designs—designs embodying definite policies of foreign nations. Our needs could hardly have been expected to be met by following the policies of these nations, and there resulted several misfits. More are bound to result unless we are guided in the design of our battleships by a definite and sound foreign policy, and in the future, as in the past, we are certain to develop units, and even whole classes, that may be excellent specimens of naval architecture, but that are entirely unsuited to the needs of the country.

STRATEGY, TACTICS AND DESIGN

Besides recommending a building programme providing for the number of battleships to be constructed each year, the General Board defines the military characteristics of our battleships, namely, the size and arrangement of battery, extent of protection, speed and radius of action, indicating the relative importance of the various main features. This definition of military characteristics is reached after having compared our national policies with those of other states as to the most probable sources of conflict, and after having considered the numbers and types of battleships of our most probable opponents. In arriving at these decisions the most valuable aids are the data derived from the analysis of the strategical problems and tactical studies of the war game worked out either by the game board of the War College or by the movements of actual ships of the fleet simulating a naval engagement. These studies have shown conclusively that—

Under modern conditions the gun is the principal weapon of the battleship, and concentration of superior gun fire at the decisive point at the critical time is always the key to victory.

With equal units, naval gun power can be assumed to vary as the square of the number of guns that can be brought to bear.

The mere possession of a greater number of units is useless unless this superiority in number can be employed in a concentrated way at the proper time.

There should be no reserves in a naval battle.

"The entire force should be brought into action as nearly simultaneously as possible, so distributed as to afford mutual support, and if practicable in such manner as to isolate a part of the enemy from the battle while the remainder is being defeated."

Reasoning from the above premises, it is obvious that concentration of armament constitutes an overwhelming advantage, and is in fact an absolute necessity. The great length of battle line and the great difficulties in maneuvering due to the number of units in the present-day fleet imperatively demand that, from the point of view of gun fire, as many main battery guns as possible should be concentrated on as few units as possible.

Armament—As long as the gun continues to be the major weapon, the main function of the battleship will be to provide the best possible platform on which to bring it into action. Our guns should possess greater power and destructive effect than those of our most probable enemy, and, since they are now no larger, we must allow for even greater calibers than we have heretofore used. While it is true that in penetrative effect the 14-inch gun at probable battle ranges can pierce any armor that it is practicable to mount in a ship, still, if we accept the principle of maximum destructive effect, we are led almost inevitably to a 16-inch caliber. Such a gun is well within the limits of the present state of the ordnance art, and possesses 30 percent more destructive effect than the present 14-inch gun of our most probable enemies. The rapidity of fire of the larger gun can be made sensibly equal to that of the smaller, and the heavier weight of projectile will allow us to adopt a relatively low muzzle velocity, by means of which both erosion and dispersion will be diminished. Such a gun possesses a materially greater range, and the priority of gun fire thus gained constitutes a material advantage.* It also possesses a greater probability of hitting at long range, and one of the most significant lessons of the European war has been that engagements have been fought and decided at 16,000 yards—a range nearly 3 miles greater than our past estimate of probable battle range.

There is a further reason why we, of all nations, should adopt the larger caliber. Such a gun materially increases displacement and cost. When the present war is over we shall be the richest of nations, and therefore best able to afford the outlay incident to the adoption of the larger gun. Politically, therefore, this may be highly advisable, because of the depressing financial effect on possible enemies similar to that occasioned by the construction of the dreadnought class by England.

Disposition and Number of Battery.—Bearing in mind the value of concentration of armament and having decided the caliber of the main battery, we come to the best arrangement of the guns.

This is largely a function of the battle formation, and until such time as this shall seem to be logically other than line or column of divisions, or simple column, our centerline vertical-echelon disposition seems best. The question of just how many guns can be advantageously mounted is hardly subject to abstract determination, but it must be quite plain that there is a point at which, after considering the other elements of a design, more guns would only result in a positive loss of efficiency. From a purely constructional point of view, this point has been reached with the four-turret centerline mounting. So overwhelming, however, are the arguments in favor of maximum possible concentration, and so great a length must be provided to obtain the desired speed, that it will probably be best to add one more centerline turret. This is particularly necessary if the 16-inch caliber be adopted, because the problems of mounting such guns in triple-gun turrets are not yet solved, and in no other way can the demands of concentration of armament be satisfied.†

Speed.—For both strategical and tactical reasons high speed is extremely desirable. If we accept the principle that an active offense is the best defense, speed is essential both for bringing the enemy to action and for maintaining the most suitable range during action. Moreover, speed, when employed in skillful maneuver, assists us to gain that relative numerical superiority which is so essential for concentration. Later on it is proposed to recur to this question of speed in considering the length of battleships, and when the excessive cost of even 2 knots greater speed than that of the enemy is appreciated it is altogether probable that we should rely on fast battle-cruisers to gain the above advantages rather than attempt to attain too great superiority of speed with the battleships.

No other single feature of a ship has so large an influence on displacement, and every fraction of a knot sacrificed will allow the displacement to be reduced many hundreds of tons. Great ships of this type will always cruise in squadron, and the speed of the squadron will be the speed of the slowest unit. This speed is a function of so many variables—condition of bottom, quality of coal, skill of personnel, condition of machinery, danger of machinery troubles at maximum speeds—and the cost inci-

* See Baudry, "The Naval Battle," p. 116.

† For further arguments in favor of restricting the number of turrets to four, see Sir William White's paper before the Society of Naval Architects and Marine Engineers, 1910, and Lieutenant Viani's paper in Supplement to *Revista Maritime*, 1908.

Generated on 2024-08-12 19:33 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

dent to any material increase is so unreasonably great that it would seem wiser to adopt comparatively moderate speed.

Armor.—There will always be a difference of opinion as to the relative importance of guns, speed and armor, but in no one of these three military characteristics is there such a wide divergence of views as in the case of armor.

But the minimum reasonable requirement of armor, aside from the local protection of turrets, barbettes, conning-tower and base of smoke-pipes afforded by their own armor, is a belt extending high enough above the normal load waterline to protect the stability, buoyancy and vital military features of the ship, and extending low enough to guard against underwater hits due to naval action, rolling of ship, or heel due to damage. Coupled with this there should be at least one protective deck—all to be of the greatest practicable thickness.

Endurance.—Other great nations of the world as well as the United States have long since abandoned the fallacy of building battleships for coast defense, with consequent small radius of action. As previously pointed out, our battleships should be capable of waging successful war in the waters of our most probable enemies. This would hardly be practicable with a smaller radius of action than 8,000 miles at 12 knots. Fortunately, the advent of fuel oil, together with increased efficiency of ship-form and propulsive machinery, renders it possible to meet this claim with comparative ease.

Protection Against Torpedo Attack.—The gun seems certain to remain the supreme weapon of offense, but this superiority is challenged more and more by the formidable menace of the torpedo and mine. No battleship has ever been provided with any sure defense against either of these dangers, and the weakest feature of all existing battleships is their lack of adequate protection against underwater attack. Even now the largest unit of any fleet can be put almost, if not quite, "out of action" by a single torpedo, and in the future there is little to prevent the use of much larger explosive charges to offset any increased subdivision or underwater armor that may be provided. It seems probable, therefore, that the chief defense against this form of attack will consist in a somewhat increased speed of battleships and a cordon of high-speed units of the destroyer type.

This comparatively new effectiveness of the submarine and its weapon, the torpedo, must exercise a powerful influence on the size and cost of individual units, and it is not at all improbable that the eventual development of the submarine may result in driving the battleship from the sea. He would indeed be a rash prophet who would venture to predict when this will come to pass, but until then the development of the battleship type must move forward or else the type must be abandoned altogether.

Technical Limitations

Design.—The design of a battleship cannot be made according to mathematical formulæ. The several elements of a design may admit occasionally of scientific treatment by means of exact empirical formulæ—for example, the buoyancy, stability and speed. But a formula or law does not exist for combining the above elements with strength, endurance, protection and armament, and arriving at the best result. This has always been, is now, and in all probability will continue to be, a matter of opinion—or, rather, difference of opinion—and so let us leave it.

Dimensions.—Displacement is determined by the principal dimensions, length, breadth and depth, and by the form of the lines. Each dimension is determined with respect to absolutely different things, and each one must be thought out carefully by itself, never forgetting at the same time certain empirical ratios with respect to each other that have been found to exist in successful ships of similar design.

Draft.—This dimension is influenced chiefly by such practical considerations as the depth of harbors and docking accommodations. It would be well, at least until harbors and docks have been further enlarged, to restrict the normal load draft of our battleships to 30 feet, the deep load draft not to exceed 32 feet.

Beam.—The question of beam is determined somewhat with regard to width of docks,* but more with regard to stability, since the position of the metacenter is determined chiefly by the beam, and the metacentric height is the most important consideration affecting the movements of a ship in a seaway.

Exact formulæ for the influence of beam on speed do not exist, but model experiments seem to bear out the fact that on a given displacement for an increase of beam of, say, 5 percent, the effective horsepower must be increased by the same percentage if the same speed is dsired, and that if length be kept constant the ratio $\frac{B}{D}$ can be varied widely without any very appreciable effect on resistance.

Length.—This dimension is influenced more by the speed than by any other feature of the design. In order to obtain high speed it is absolutely necessary to have length. Not only will the shorter ship require much more horsepower for a given speed, but affords less length for the installation of the increased horsepower, so that practically the length must be great enough to enable the necessary machinery to be installed.

On the other hand, by a too great increase in length we reach a point where the frictional resistance due to increased wetted surface is greater than the gain from reduced wave-making resistance, particularly at cruising speeds. Length is not favorable for maneuvering, increasing the resistance to turning. Length necessitates a serious increase in displacement, due to the greater weight of armor and hull for the same protection and same length. Greater length means greater target area, and incidentally there are but few dry docks that will accommodate great lengths.

Displacement.—Many other features must be given their relative weight, the chief of which are seaworthiness, freeboard, and type of hull fittings, but enough has been said to indicate the principal military and technical considerations influencing and limiting battleship displacement.

Passing over the more or less mechanical end of the calculations involved, it may be stated that, in the present state of the art of the naval architect and marine engineer, it is not possible to adequately fulfill these principal claims on less dimensions than 640 feet for length, 96 feet for beam and 30 feet for draft, with a consequent displacement of approximately 36,000 tons.

Cost

A study of the relative costs of large and small battleships should properly include not only the first or "prime" cost, but the cost of maintenance as well. As regards first cost, perhaps the briefest way to indicate the practical relation in battleship construction existing between cost, displacement and effective gun power is to state that, by increasing the cost one-half and the displacement one-third, it is possible to produce a unit with double the effective gun fire.

Consequently, if smaller and more numerous units are

* It is limited, for the present, at least, by the 110-foot width of the Panama Canal locks.

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

constructed for the same expenditure, each with an effective gun fire equal to one-half that of our type ship, we may expect to provide only three smaller vessels for every two larger ones; and the effective gun power of the two large ships would be one-third greater than that of the three smaller ships (i. e., in the proportion of 2 to 1.5). Moreover, the cost per annum of manning and maintaining the more numerous fleet will be materially greater. It may be conservatively estimated that this increased cost of maintenance of the three small ships over that of the two larger ones will be less than 5 percent per annum. Assuming the life of a capital ship to be twenty years, it will cost 100 percent more to man and maintain the more numerous fleet. It is also to be observed that, although the cost per unit for "large" ships is much greater, the risk of total loss is correspondingly smaller on account of the better subdivision possible to provide on the larger ship, and the greater distance from the skin of the ship at which it is possible to place the boilers and magazines.

FIGHTING VALUE

Many advantages of the larger units become greater and more accentuated when the fighting value of a fleet of units is considered. This is particularly true when we compare fleets of equal cost. It has been shown that for a given expenditure of money it is possible to provide one-third more gun power on larger vessels than on smaller vessels each of gun power equivalent to one-half the larger vessels.

If the caliber of guns in the two fleets be assumed equal, then the larger ships possess a one-third greater numerical superiority. This would indicate that the fighting power of the large ships with relation to that of the small ships is in the proportion of

$$\left(\frac{4}{3}\right)^2 = \frac{16}{9} = 1.77.$$

Furthermore, the destructive value of a fleet is determined not only by the fighting value of its units, but by the method of employing that fighting value. The principal factors in connection with the method of employing fighting value are (1) maneuver, and (2) fire control. Maneuver enables a fleet to gain that relative numerical superiority of guns required by the principle of concentration. The fewer number of units in the fleet of large ships allows a greater ease of maneuver on account of the handiness of a short line as compared with the clumsiness of a long one, apart from such matters as visability of signals, etc. If it is argued that the smaller, and therefore more numerous, fleet possesses a larger power of combination, the answer is that in a naval battle it is not power of combination that we desire, but power of concentration.

From the point of view of fire control, the big ship again has a great advantage. Assume three small ships fighting one large one. To anyone who has witnessed long-range target practice and attempted to spot the fall of salvos, it is at once apparent how extremely difficult, if not indeed impossible, it would be to identify the salvos of the three smaller ships as they fall about the large one, whereas the fire-control officer and spotter of the single large ship can concentrate their salvos on either one or two of the smaller ships, identifying unerringly each salvo. The advantage of the small ships due to the "dispersion of target" offered by them would be more than counterbalanced by the great handicap of being unable to identify their salvos.

CONCLUSION

Since the ultimate purpose in modern war is the disruption and destruction of the organized forces of the enemy, the purpose of our battleship fleet is neither the defense of our coast, the blockade of the enemy's fleet in his ports, the capture of sea-coast forts, nor even the "command of the sea." Its mission—its sole mission—is battle, the complete and relentless destruction of the enemy's battle fleet. To this end it must possess at the outset and maintain by maneuver during battle that relative superiority which is the key of all decisive battles by land or by sea. This can be obtained most certainly, and at a much less cost per gun, by concentration of fighting power in large units.

It has been shown that the fulfilment of the present-day claims on the military and technical characteristics of battleship design imperatively demands a ship of large displacement. It has also been shown how each element of a design can be benefited by an increase of displacement. Apart, however, from this gain, the larger ship possesses certain inherent advantages over the smaller one that more than outweigh the disadvantages due to size:

Greater concentration of armament.

Better protection of buoyancy and stability by comparatively more minute subdivision.

Greater protection by armor, because the thickness of armor need not be increased with displacement, and the same area will protect a greater tonnage.

More economical propulsion.

Greater radius of action.

Greater sustained sea speed under all conditions of weather.

Greater efficiency per gun due to the wide separation of turrets, machinery, magazines, etc., also on account of the greater safeguards it is possible to provide on the large ship with regard to the supply of power, ammunition and every other essential that serves the gun.

Moreover, it is only large displacement which makes it possible to provide that adequate protection against underwater attack which is becoming more and more necessary and which cannot be provided with smaller displacements.

These are the reasons that demonstrate so convincingly the value of the larger ship and that will force us inevitably to build larger and even larger units until such time as the improvement in submarine and aerial offense shall drive the present battleship type from the sea forever.

Werkspoor Marine Diesel Engine

In a paper presented at the recent annual meeting of the American Society of Mechanical Engineers, Mr. Thomas O. Lisle reviewed the results of six years' development of the Werkspoor marine Diesel engine. The firm of Werkspoor has to date completed the engines of twenty-four seagoing mercantile ships, representing a total of about 35,000 horsepower.

Werkspoor was one of the first firms in the world to build Diesel-type engines on an extensive scale, having been building stationary motors of this class for over sixteen years. Despite this experience, and although they had also the benefit of about half a century's marine engine construction, their first attempts at building the machinery of motor ships were most modest. When the firm first turned its attention to marine Diesel engines, it decided that, unless the engine can be repaired in any port in the world where steam engines can be repaired, it is of no use to ocean-going ships. To this day they have adhered to this policy, consequently their engine is exactly similar to any of the marine steam engines.

The review included illustrations taken from the engines of the twenty-four vessels constructed by the concern.

Generated on 2024-08-12 19:33 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

THE STANDARD SHIPBUILDING CORPORATION

Builders of Standard Freight Steamers

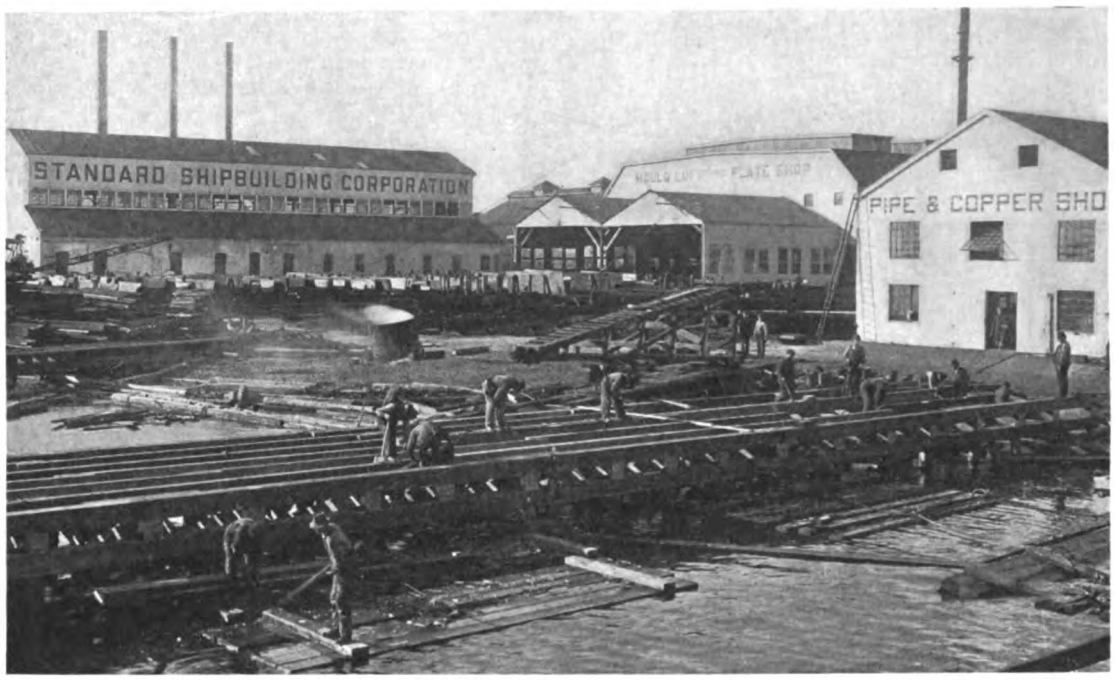


Fig. 1.—General View of Shooters Island Shipyard

Fig. 2.—Interior of Machine Shop

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Fig. 3.—Ship Ways of Standard Shipbuilding Corporation

The Standard Shipbuilding Corporation and Its Standard Ship

New Equipment Installed at Shooters Island Shipyard for Building Standard Cargo Vessels—Capacity of Eighteen Ships a Year Planned

WHAT Henry Ford has done with automobiles, the Standard Shipbuilding Corporation, of New York, is doing with merchant ships: it has adopted one single type and size as standard and will turn out nothing else.

Those not familiar with manufacturing processes may question the advantages of this policy of standardization and wonder what is gained by restricting one's product in so rigid a fashion. But a brief outline of the method pursued by the Standard Corporation will make clear why the adherence to a definite standard benefits greatly both builder and buyer.

After an extensive preliminary investigation a model vessel that will suit the great majority of users was selected as the standard. Since there was to be only one design it could be drawn up with the greatest care, and neither time, effort, nor expense spared to make it as perfect as possible and provide all of the proven and most efficient equipment.

Each part, from the largest to the smallest, is standardized and a special machine assigned to its production, thus insuring the utmost rapidity of output and the highest operating economy.

When one of these standard ships is to be built every

Fig. 4.—24-Foot Plate Planer

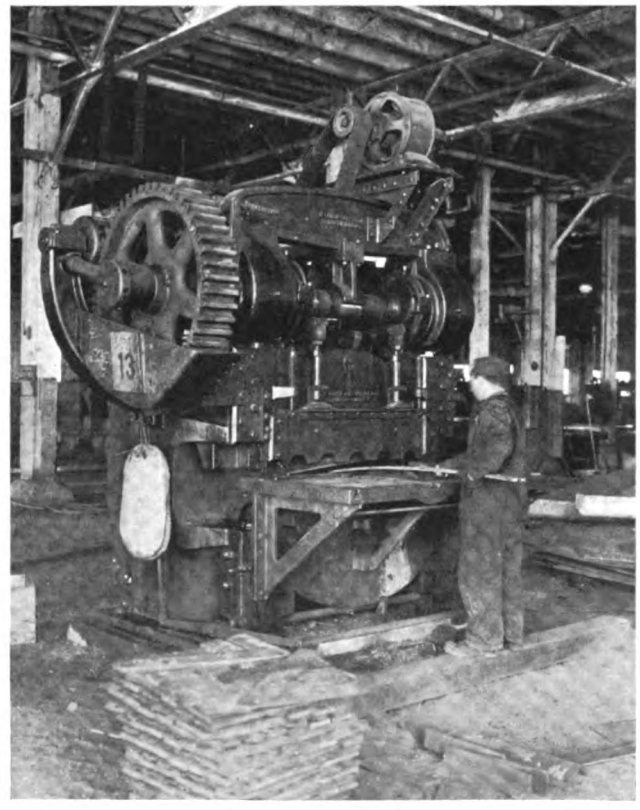


Fig. 5.—Gate Shear

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

THE STANDARD SHIPBUILDING CORPORATION

Builders of Standard Freight Steamers

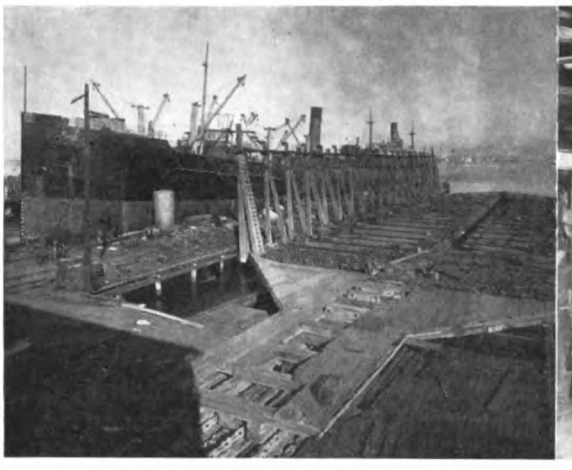


Fig. 6.—Marine Railway

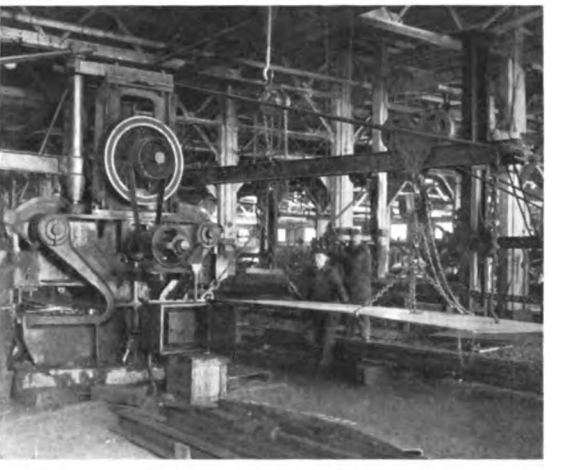


Fig. 7.—Punch and Shear

Fig. 8.—Power House. 500-Kilowatt Westinghouse Generators

Fig. 9.—Pattern Shop

Fig. 10.—Punch

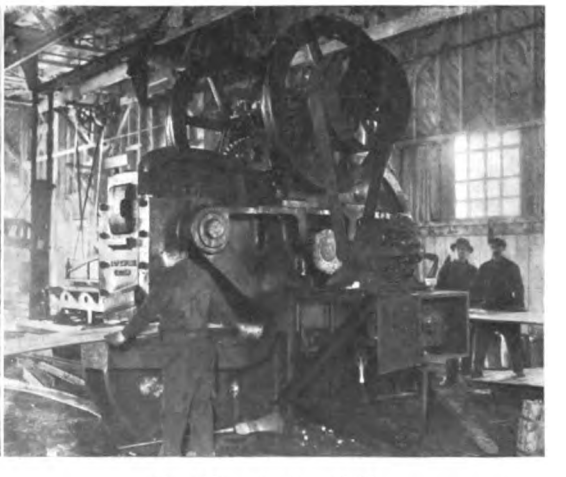


Fig. 11.—Punch and Shear

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

item that goes into her is completed and ready for erection. The standard parts are handled in a standard manner, according to a standard schedule, and fitted together in a standard way. Each workman does the same identical thing that he has done many times before, so that the whole operation goes like clockwork and the ship is put together and launched within the shortest possible time and at the lowest possible cost.

THE STANDARD SHIP

Of course, this is not an entirely new idea. It has been attempted before, but always, heretofore, some changes have been made for one purchaser, other changes for the next, and so on, until at last each ship is being specially built, and the standard has vanished. "We shall do nothing like that," says the Standard Shipbuilding Corporation. "We will give the purchaser the best ship we are able to produce, along lines which have been proved by experience to be the most adaptable for general cargo service, and we believe that such a ship will prove to be the most satisfactory to the purchaser in the long run."

The details of this standard cargo steamship are as follows:

Length	392 feet
Beam	52 feet
Deadweight capacity	7,300 tons
Indicated horsepower	2,500
Speed	10½ knots

She will have the latest appliances for handling the cargo and for insuring the safety and comfort of the crew, and will be classed + 100 A-1 by Lloyd's.

THE REMODELED SHIPYARD

The yard is located on Shooters Island, which is just off Staten Island in New York harbor. An old plant was purchased and entirely remodeled to suit the new requirements. One feature of the remodeling was the modernizing of the drive of the various machines. Originally each machine—shear, punch, roll, etc.—was driven by steam engines. With such a drive rapid and economical production is an impossibility, so that Westinghouse electric motors were installed throughout. The application of these motors proved, however, quite a problem, for a large part of the machinery was of sturdy Scotch construction and nothing was known in this country about its power requirements. A careful study of each machine was made by the motor manufacturers, and a system of belted motor drive installed that has proved perfectly satisfactory in every respect. Power for the motors is supplied by a 500-kilowatt Westinghouse generator.

In the plate shop, individual motors are used for each machine, as this gives the most satisfactory drive with the least complication of belts and line shafting. Each machine is independent, can be located wherever desired, its position changed without difficulty, and trouble with one machine does not affect the operation of any other.

In the machine shop the original line shaft drive is still in use, four motors at present driving all the machinery, but the new machine tools being installed are all individually motor-driven.

Operations were started by the Standard Corporation in January, 1916, and six modern shipbuilding berths have been provided. The first three ships are well along, the keels having been laid in October, and the fabrication of the second three ships is well advanced.

The latest and most modern equipment, shops, etc., are being installed in addition to that already in operation, and when completed the plant will have a capacity of eighteen standard cargo steamers per year.

Typical Refrigerating Plants for Ships' Stores on Ocean-Going Cargo Vessels

For the benefit of those of our readers who are interested in the refrigeration of ships' stores, we present the following descriptions of two refrigerating installations on ocean-going cargo vessels as carried out by the Shipley Construction & Supply Company, of Brooklyn, N. Y.

Fig. 2 shows in detail the arrangement of the cold room and York ammonia refrigerating machine, as fitted on the steamship *Valdivia*. It will be of interest to know that this entire installation of cold room installation and machinery complete was installed and operated ready to receive provisions between Wednesday morning and Saturday night, the time during which the vessel was loading outward freight in New York harbor.

The space occupied by the cold room is located on the port side in the upper 'tween deck space, abaft the engine

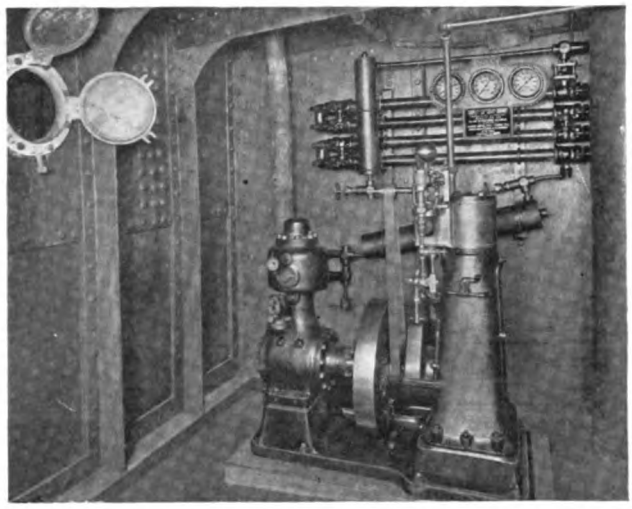


Fig. 1.—York Refrigerating Plant Installed on Steamship *Valdivia*

room bulkhead, and is contained in a steel casing forming a trunkway on the port side of No. 3 cargo hatch. This feature was specially desirable, as it enabled two doors to be placed in the cold chamber, one on the starboard side and the other on the forward end. The door on the starboard side opens into the trunked hatchway and enabled the provisions to be loaded into the cold room directly from the hatchway, and to be removed for the steward's department, as required, through the door in the forward end leading to the passageway, direct to the ship's galley and pantry.

The capacity of the cold chamber is 450 cubic feet. The chamber is fitted on its port and starboard sides and after ends with direct expansion ammonia cooling coils, which are clearly shown in the plans. Over these cooling coils are placed battens to prevent the provisions from coming into direct contact with the cooling coils. A slatted rack is provided along the whole length of the starboard side for the convenient stowage of small provisions, and, in addition, three meat rails are provided under the deck the whole length of the room, enabling beef to be hung in quarters. It will be noted that the insulation throughout consists of 6 inches of regranulated cork packed between the ship's frames on the port side, the ship's beams overhead, the casing stiffeners on the aft end and starboard side, and between uprights on the forward end.

The temperatures in the room are maintained at about 28 degrees, which is sufficiently cool for the purpose of cooling ships' stores. Fig. 2 shows the position of the

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

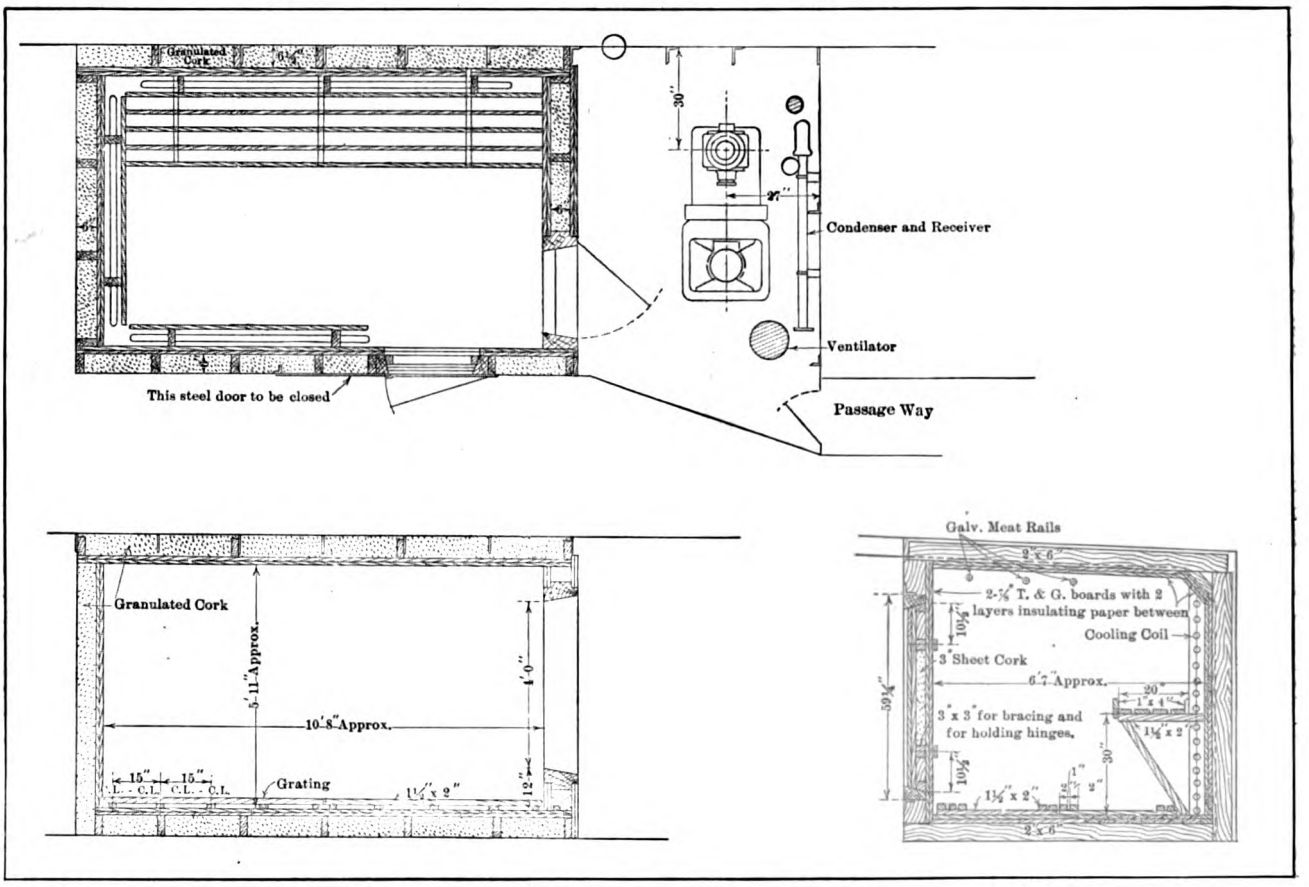


Fig. 2.—Refrigerating Rooms and Machinery, S. S. *Valdivia*

cooling coils which are entirely on the sides, and also the details of the gratings, shelving and cargo battens provided in the cold room. The refrigerating machinery, as shown in Fig. 1, is placed at the forward end of the cold room, and consists of a one-ton York steam-driven, vertical refrigerating machine, with its condenser, oil separator, and liquid ammonia receiver, forming a self-contained unit. The space occupied by this machinery is 5 feet long and 3 feet 6 inches in width, but the machine room space is sufficiently large to allow ample handling room for operation and overhauling, and to make use of the existing sidelight (shown on the port side in the first frame space forward of the cold room) and the ventilator passing through the machinery space.

At sea these machines are very economical in their

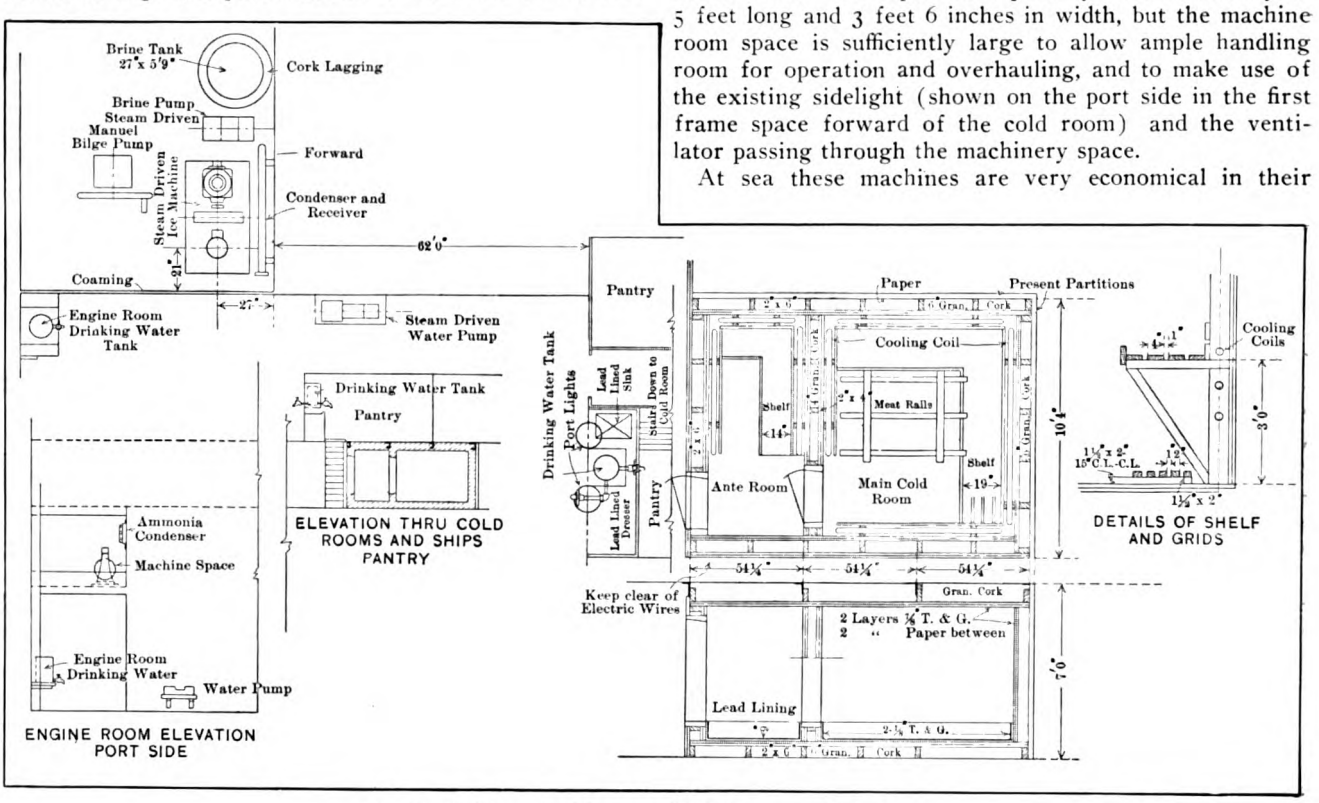


Fig. 3.—Refrigerating Rooms and Machinery on S. S. *Arna*

Generated on 2024-08-12 19:55 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

operation, as the exhaust steam can be utilized through the feed water heater, and so return the greater part of its heat energy for further use. The engine and compressor are of the enclosed, automatic lubrication type, and therefore require very little attention on the part of the engineering staff.

It will be noted that as the cold room and the refrigerating machinery room are adjacent to one another, very short lines of ammonia piping can be utilized, with resultingly few joints and a corresponding reduction in the chances of ammonia leakage.

Where the machinery and cold room may be similarly located, this type of installation is perhaps the simplest and least troublesome that can be fitted, and there are many hundreds of such installations in daily use, all giving first-class satisfaction. Where the cold room is to be situated at a coniderable distance from the refrigerating machinery, it is inadvisable to use ammonia as a direct cooling agent in the cold chambers, on account of the possibility of leakage by the fracture of a pipe where the ammonia pipes are carried through cargo spaces or bunkers.

In such cases it is convenient to use brine as a direct cooling agent for the chambers and provide, in addition to the equipment enumerated for the steamship *Valdivia*, a brine cooling tank and brine circulating pump, so that the brine tank may be placed adjacent to the refrigerating machine. The tank is fitted with a brine cooling coil by means of which the ammonia machine cools the brine in the tank. The cold brine is then circulated by means of the brine pump through the cold rooms or other parts to be cooled and returned to the brine tank for re-use, forming a complete brine cycle.

Fig. 3 illustrates such a plant recently installed by the same company on the Norwegian steamship *Arna* in the port of New York. The installation was commenced on Tuesday and completed on the following Monday, during the time the vessel was loading cargo in this port. The plant, as already stated, consists of a one-ton York steam-driven ammonia machine, with its condenser, oil separator and ammonia receiver, a brine cooling tank, brine pump and water circulating pump, both steam-driven, also two insulated drinking water tanks and two cold rooms.

The cold room space is subdivided into a main and ante-room, both piped, and fitted with gratings, shelves and battens for the brine pipes. The inner room is used as a main storage for provisions and the ante-room as a daily requirement storage. This arrangement is very satisfactory, both to the steward's and engineering departments of the vessel, as it is unnecessary to open the door leading to the main room frequently. A suitable temperature for this room with its contents can then be more easily maintained than would be the case if the door to the outside warm air had to be continually opened. This arrangement is recommended by the manufacturers wherever possible to all users of refrigerating machinery for this purpose.

The drinking water-cooling tanks are cooled by a separate brine circulation independently controlled. One is placed in a convenient position for easy access on the port side of the lower platform in the main engine room and furnishes cold drinking water for the engine room staff. The other is placed in the pantry amidships, furnishing cold drinking water to the steward's department and the men in the deck department. The latter draw their drinking water from a spring-controlled, self-closing tap, placed on the outside of the deck house. Water for pantry use is drawn from a self-closing faucet placed directly in the pantry.

The construction of the cold chambers is similar to that described for the steamship *Valdivia*, and consists of 6 inches of regranulated cork. It will be noted that the fore and aft distance between the after end of the pantry and the forward end of the machinery space is 62 feet and about 200 feet of brine discharge and return piping were required to connect the brine pump, cold rooms, drinking water tanks and brine tank. This piping was carried through the port 'tween deck bunker space, heavily insulated with molded cork covering and further protected by heavy wooden casings.

The knowledge of such installations should convince owners that their existing cargo vessels may be readily fitted with complete refrigerating equipment for ships' stores during the time the vessel is working cargo in port. It frequently has been demonstrated that when ships' stores are carried in properly fitted and fully equipped refrigerated spaces as compared with the old method of storing provisions with ice, there is a resulting gain, not only from the cost of installing and operating the refrigerating machinery as compared with the cost of ice, but there is a further decided saving in the cost of provisioning the vessel, due to the food being kept in a better and more sanitary condition, eliminating almost entirely losses due to rotting of provisions.

The United States Coast Guard

According to the annual report of the United States Coast Guard, recently issued, the lives of 1,216 persons were actually saved during the fiscal year ended June 30, 1916, through the agency of the Coast Guard cutters and stations. There were 1,453 instances of service involving the saving of life or the salving of property imperiled. Assistance was given in various ways to 15,742 persons on board vessels. The total appraised value of property saved from immediate jeopardy was $10,638,555 (£2,180,000). The cost of maintaining the service for the year was $5,215,711.34 (£1,070,000). During the entire year there were but three days when the Coast Guard was not actively engaged in some form of public benefaction. The daily average number of cases for the year involving rescue work was approximately ten, while the maximum number for any one day was 77. These results emphasize the great importance of keeping the cutters and stations in the highest state of efficiency and readiness in order that they may promptly and adequately at all times meet the calls of assistance coming from the various sources of need.

The removal or destruction of dangerous derelicts in the paths of steamers has been prosecuted with the usual vigor in the past year. There were thirty of these menaces destroyed or otherwise removed. The past year was the last of ten years since records have been compiled of this activity. During that decade 268 derelicts were destroyed or removed—an average of 26.8 per year.

The equipment of the Coast Guard includes 23 cruising cutters, 24 harbor cutters and 279 stations. Recommendations are made in the report for the appropriation of $350,000 (£72,000) for the construction of a new cruising cutter to replace the *Morrill*, stationed at Detroit, Mich., which is now twenty-seven years old and is too antiquated and entirely inadequate in size and power effectively to perform the duties required at this station. An appropriation of $400,000 (£82,000) is also recommended to provide a cutter for replacing the *Thetis*, formerly stationed at Honolulu, which it was found necessary to condemn and dispose of. The dangerous vicinity off Cape Hatteras is also in urgent need of an efficient Coast Guard cutter to supplement the work of the *Onondaga*, stationed at Norfolk, Va., and the *Seminole*, with headquarters at Wilmington, N. C.

Generated on 2024-08-12 19:55 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Why is a Door?

"Old Mac," the Practical Ship Draftsman, During the Noon Hour Gives "the Cubs" Some Useful Advice About Doors

YOUNG Stevens and Tek Johnson were having an argument about the proper way to calculate the strength and deflection of a watertight bulkhead. It was noon time and they had picked up a preliminary copy of an article to be read at a coming meeting of the Society of Naval Architects.

Tek (so nicknamed because he is our latest arrival from college) had his slide rule, which was a high-priced instrument on which were numerous extra and mysterious scales. He was proving a lot of imaginary things with it and was getting decidedly the best of young Stevens, until Old Mac came in.

Old Mac had just finished his pipe and taken his daily turn around the yard. As he came down the office through the line of boards he overheard part of the argument. As he and the elder Stevens are strong friends, Mac rather looks after young Stevens in the drawing room.

Although Mac is a bachelor and the office knows that he generally keeps the kids off at arm's length, nevertheless he has made an exception of young Stevens. The old maid stenographer always says that Stevens, Sr., and Mac used to take candy to the same girl, and that young Stevens looks like his mother—hence the soft spot.

Mac went over to his board, knocked the ashes out of his pipe, hung up his hat and sat listening to the argument. Tek was surely getting the best of it. Mac took off his glasses, laid them on the board in front of him and thoughtfully scratched his nose where the glasses had left a red line. All morning he had been listening to the vague talk of an owner's inspector, who, in possession of a little knowledge of the game, had conceived the idea that it was his mission in life to revolutionize the shipbuilding business. Mac had nearly exploded a couple of times, and as he listened to Tek his patience finally became exhausted, and he called out:

"Hey! You kids, come over here! What do you know about bulkhead stiffeners, anyway? Neither one of you can make a good, legible tracing yet. Tek, if you ever get a bulkhead to draw, don't worry about stiffeners—they will be specified. Throw that freak slide rule in the waste basket, shut up and learn to trace. Who do you think you are, anyway?"

Tek was rather taken back, but he loves his slide r· and is kind of stubborn, so he came back with, "Don't the chief want us to learn all we can?"

"Sure he does," replied Mac, "but study something practical and possible. The fellow who wrote that article has time and money to spare and wants to advertise. Yo don't want to advertise because if you are too well known you will lose your job. Lay low. You know why you washed out that last tracing you nearly finished. All tracing cloth is not made for pen wipers, you know. The scraps are enough."

"Well, what do you want me to do?" asked Tek.

"Trade that slide rule for a flock of two-foot rules and go down in the yard and measure up some of the common things you have got to know well before you can draw at all," said Mac. "Remember that the fellow who draws best, draws the most water and the largest check at the end of the month."

"What do you want me to measure, for instance?" asked Tek.

"Well, now, I'll tell you," replied Mac; "I am going to ask you kids some questions every once in awhile, and what you don't know, find out in the yard.

"In the first place, why is a door?"

"What do you mean?" asked the boys.

"Why do we have them; how big are they; what do they weigh and what do they cost, etc.? Listen and I will tell you something about doors that is not in books, and something that a first-class draftsman has got to know.

"A door serves as a passageway and also serves to close up that passageway. Yes, you know all that, but maybe you do not know that a whole lot of times young fellows like you have drawn in doors that could not be opened and have felt mighty cheap when some noisy fellow in the yard found it out when he tried to do it and couldn't. Oftentimes there are deck beams, bulkhead stiffeners, stiffener brackets, deck foundation stiffening, piping, etc., that block a door completely.

"A good, standard watertight door has a clear opening 24 inches wide by 5 feet high. The top of this opening is located to give head room or the bottom may be located high enough to suit the coaming that may form part of the bulkhead or casing. Good head room is 6 feet or 6 feet 2 inches. Some people put the bottom of the opening uniformly 9 inches above the deck. In this case you have to duck your head a little, but you do not have to step so high. Such doors have dogs that jam a rubber gasket on the door proper against the door frame on the budkhead.

"Simpson's handbook gives a good door detail, and every yard that has built more than one ship has a standard door plan. If you ever have to draw in such a door, be careful to see that the door will open and the stiffener next the hinge side of the door clears the hinges and that the dogs, handle, etc., don't foul other stiffeners and prevent the door from stowing out of the way.

"A 5-foot 2-inch, watertight door weighs, complete, about 575 pounds and costs, installed, roughly, $175 (36 9/2). These are approximate figures, of course, but for a couple of kids who might at a guess give the weight of such a door at from 100 to 1,000 pounds they are good enough to get ideas properly formed.

"Non-watertight doors are lighter, cheaper and generally larger. They are made to suit house or casing plating. Here, a 5-foot 2-inch or 5-foot 6-inch by 2-foot 2-inch door is a good standard size. This door is nothing more than a plate that lands on the heel or toe of the casing stiffeners and has a stiffening flat iron piece around the edge that projects enough to cover the crack and give a finish. A non-watertight door 5 feet 6 inches by 2 feet 2 inches will weigh about 175 pounds and cost about $40 (8 6 8) installed. These doors are simple, but the drawing office has generally to order the hardware.

"This hardware is important, and more than once the store has had to use its friendly relations with the manufacturer to straighten out some wild bill of material that some inexperienced draftsman has innocently inflicted upon the yard.

"The hinges are steel-drop forgings generally. The male part is riveted to the door proper and the pin is about ¾ inch diameter. These doors generally hinge forward and out and have a fairly heavy bronze rim lock. Reversible locks can be bought, but often rights and lefts have to be ordered. This is the way you distinguish. Imagine that you stand opening the door away from you.

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

The hand that you take hold of the knob with is the hand of the lock and hinges. See, here is a sketch, right-left.

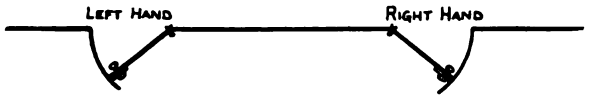


Fig. 1

"These locks have a striker, knobs (sometimes ring handles) and a key. The knob is about 42 inches above the deck unless some detail of the door finish, such as the size of the panel, etc., makes it necessary to move it higher or lower. Sometimes a lock is not fitted, but only a sliding bolt is used. Remember also that some kind of a hook must be furnished to hold the door open. They are heavy, and a ship rolls and pitches and the wind blows. A hook about ¼ inch in diameter and fastened to the door and casing by a small-shouldered eye bolt (⅜ inch diameter) does nicely.

"The door plate is the same weight or lighter than the casing plating, and the bottom of the opening is the top of the coaming. A horizontal stiffener usually forms the sill, but sometimes a cast brass sill is fitted and fastened to the coaming and the vertical stiffeners. Brass or enameled name plates are fitted to the door or to the casing just above. The door that has a sliding bolt has a handle.

"In the quarters wooden doors are used, and here, as in the case of the steel door, the drawing office has to worry out the hardware. Rim and mortise locks are used. A rim lock is fastened on the face or rim of the door, while the mortise lock is mortised or let into the door. Rights and lefts may be ordered and key-hole plates must be thought of. The hinges for such doors are listed in the catalogues as butts, and are measured with the leaves extended, as shown in Fig. 2.

"This is a 4-inch by 4-inch. The length dimension must be given first. Many a brave lad who did not know better has called this a 4-inch by 2-inch, and has been called down for it. There are acorn and plain top hinges and hinges with a loose pin, tight pin, and loose joint. Be careful. Two hinges located about 12 inches from top and bottom are enough for the ordinary door.

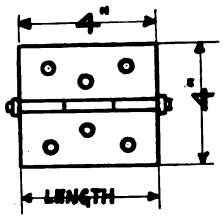


Fig. 2

"A cast brass sill may be fitted, as in the case of the steel door, or a sheet brass piece may be used instead. I remember when I took a lot of pride and wasted a lot of time putting the ship's name in copper tacks on some of these sills.

"When light sheet metal bulkheads are used—tin bulkheads they call them—sheet metal doors are fitted, instead of wooden doors. These doors cost about $40 (8 6 8) and weigh about 90 pounds, complete, with a trim that is fitted to and forms part of the tin bulkhead. Such doors are generally bought on the outside and the drawing office has only to give the size, right or left hand, etc. The door manufacturer furnishes the hardware and sends the door painted and ready to put in place. Sometimes they are fairly elaborate and have glass panels, sliding blinds, etc."

The whistle blew. Old Mac picked up his glasses and Tek beat it. Young Stevens hung around, and finally asked how he could remember all the things Mac had told him.

"When you see a door in your travels," continued Mac, "size it up and notice the hardware on it. Talk to the fellows on the ship who are puting it up. In a little while you will have it down fine and with a very little effort. You will have acquired a practical point of view and see a lot of important things that these slide-rule fellows don't know exist. Cut out this theoretical stuff. It don't get you anywhere, wastes your time and fills up your head to the exclusion of profitable, practical things."

Stevens went to work impressed.

Later in the afternoon Old Mac looked around. Tek was monkeying with his slide rule. Mac watched him awhile, and it seemed to me that he was trying to figure how Tek was using his slide rule to trace with. Then he looked at Young Stevens, who was busy tracing and oblivious to the rest of the office. His look seemed to go beyond Stevens, and his face softened.

Somehow, as I watched him, I was convinced that the old maid stenographer is right about the candy episode. Finally, he shrugged his shoulders and went to work again.

He surely would have gone up in the air if he had known that Tek had been trying for some time to see if he could find some way of figuring the cost of a door from its weight and adding another constant to the back of his already mysterious slide rule.

Saving in Construction of Battleship Arizona

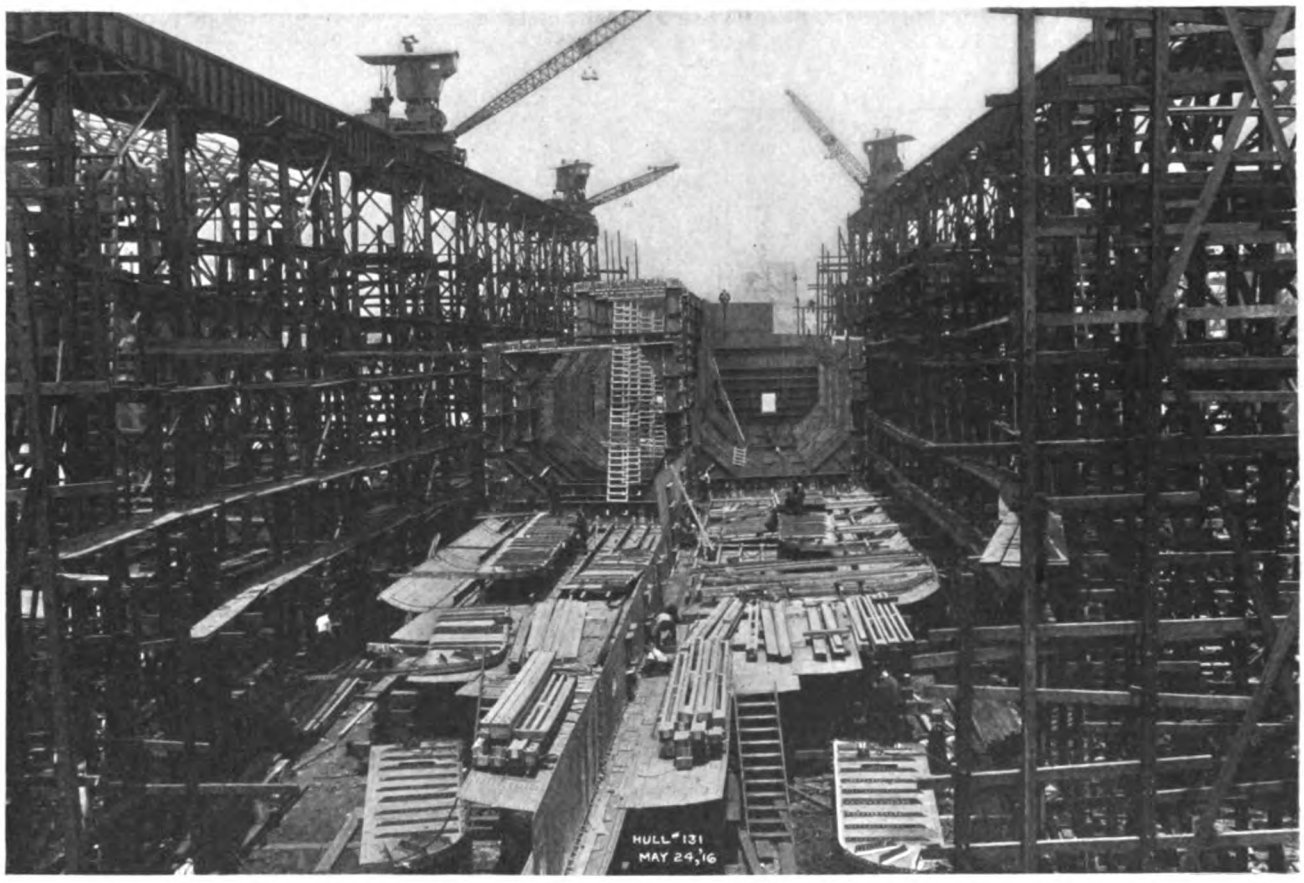
The construction of the battleship *Arizona* at the New York Navy Yard, according to the annual report of the Secretary of the Navy, demonstrates that there has been an increase of efficiency in new construction at that yard. The actual cost of the *Arizona* as compared with that of the *New York* and *Florida*, the preceding battleships built at the New York Yard, was much less, notwithstanding the present strenuous conditions due to the great war in Europe, which has increased all expenses for material and labor in shipbuilding in this country.

The actual saving as reported by Captain G. E. Burd, industrial manager of the New York yard, in the construction of the *Arizona*, was $678,239.82 (£139,000), but due to the scarcity of labor it was necessary to pay $133,729.95 (£27,400) in bonuses for overtime work which would not have been required in ordinary times. Without the payment of bonuses the saving would have been $811,969.77 (£166,400)

The comparison of the cost per ton of the *Florida*, *New York* and *Arizona* is illuminating. The cost per ton for building the *Florida* was $286 (£58.7); for building the *New York*, $233.53 (£47.9), and for the *Arizona*, $210.62 (£43.2). That this decrease in cost per ton was made notwithstanding the considerable increase in wages and cost of material and increasing number of expensive appliances installed on new ships, demonstrates, in the opinion of the Secretary of the Navy, the wisdom of ordering the construction of this ship at the New York Navy Yard.

At the beginning of Secretary Daniels' administration but one navy yard was equipped for building battleships, that was the New York Navy Yard, and only one other navy yard—that at Mare Island—was equipped for building auxiliary vessels. As the cost of all the United States navy yards and their equipment represented an investment of about $150,000,000 (£30,750,000), steps were taken to utilize to a far greater extent these expensive plants for building naval vessels. At the present time battleships are under construction at two of the navy yards, auxiliary vessels at two others, destroyers at two others, and submarines at still another navy yard. In addition to this, the recent naval act authorizes the expenditure of $6,000,000 (£1,230,000) for further fitting of navy yards for shipbuilding.

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN



The Construction of Oil Tank Steamships Has Been a Prominent Feature of the Year's Work in American Shipyards. Oil Tanker Under Construction at the Union Iron Works, San Francisco

Shipbuilding in the United States in 1916

Over 500 Merchant Vessels of 1,718,338 Gross Tons Now Under Construction—263 Merchant Vessels of 491,161 Gross Tons Built in 1916

ACCORDING to reports sent to MARINE ENGINEERING from practically every shipyard in the United States, there are at the present time under construction in the private shipyards of the country 506 merchant vessels of 1,718,338 gross tons. In addition to the merchant work the private shipyards are building 53 naval vessels aggregating 174,021 tons.

The output of the private yards during 1916 amounted to 263 merchant vessels of 491,161 gross tons and 15 naval vessels of 45,925 tons.

The character of the output is significant, as it consists principally of sea-going cargo boats and oil tankers. In 1916, 47 sea-going freight steamers of 186,493 gross tons were built and 27 oil tank steamships of 180,156 gross tons. In the work now on hand there are 158 freighters of 794,963 gross tons and 64 oil tankers of 450,263 gross tons. Only a small portion of the output consists of passenger ships, and these are for coastwise service or for use on inland waterways.

As shown in Tables I and II, which give the number, tonnage and horsepower of both merchant and naval vessels built by American shipbuilders in 1916, and corresponding figures for the work now under construction or contracted for, it will be seen that the largest output of merchant tonnage in 1916 was from the Union Iron Works, San Francisco, Cal., while nearly an equal amount was produced on the Great Lakes by the American Shipbuilding Company. Of the shipbuilders on the Atlantic coast the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., produced the largest amount of merchant tonnage.

Considering the work now on hand, it is seen that again the Union Iron Works leads with the greatest volume of merchant tonnage under construction, with the New York Shipbuilding Company, Camden, N. J., second. A noteworthy feature of these returns is the fact that not only are the old established yards filled practically to capacity, but also many of the newly established yards have a volume of tonnage booked equal to, if not greater than, the normal output of the older yards in previous years.

Concurrent with this report there has been published in the annual report of the Commissioner of Navigation, Department of Commerce, figures covering the output of American shipyards for the fiscal year ending June 30, 1916. According to this report 937 vessels of 325,413 gross tons were built and officially documented in the United States, compared with 1,157 vessels of 225,122 gross tons for the previous year. These figures cover only the vessels built and put into commission during the year, and by no means indicate the remarkable activity in all American shipyards, which began late in the calendar year 1915 and steadily increased well into the current fiscal

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

TABLE I.—MERCHANT CONSTRUCTION

SHIPS BUILT IN 1916

	No.	Gross Tons	H. P.
Union Iron Works	9	65,293	24,400
American Shipbuilding Company	19	64,000	25,200
Newport News Shipbuilding & Dry Dock Company	7	51,737	20,300
Great Lakes Engineering Works	14	35,214	19,175
Wm. Cramp & Sons Ship and Engine Building Company	7	34,996	16,800
Fore River Shipbuilding Corporation	5	33,082	15,300
Bethlehem Steel Company (Maryland)	8	31,952	18,400
New York Shipbuilding Company	9	27,474	10,150
Harlan & Hollingsworth Corporation	5	18,835	20,434
Moore & Scott Iron Works	2	14,200	4,800
American Bridge Company	31	12,129	....
Toledo Shipbuilding Company	6	11,820	1,920
Skinner & Eddy Shipbuilding Corporation	2	11,460	5,000
Chester Shipbuilding Company	2	11,000	....
Baltimore Dry Dock & Shipbuilding Co.	4	10,603	4,500
American Car & Foundry Company	25	10,567	....
Kelly-Spear Company	6	4,035	....
Seattle Construction & Dry Dock Co.	1	4,000	2,500
Wilmington Iron Works	2	4,000	1,400
Mathews Shipbuilding Company	3	2,921	1,940
Peterson Shipbuilding Company	3	2,800	....
St. Helens Shipbuilding Company	3	2,783	1,040
Kruse & Banks	2	2,450	2,200
Manitowoc Shipbuilding Company	6	2,324	3,400
M. M. Davis & Son	5	2,250	1,025
E. J. Tull	4	1,940	45
Wilson Bros. Shipyard	2	1,920	1,700
G. G. Deering Co.	1	1,891	....
Percy & Small	2	1,620	....
Staten Island Shipbuilding Company	5	1,511	2,350
Tank Shipbuilding Company	3	1,257	....
Howard Shipyards Company	3	1,225	1,075
John Wilson Shipbuilding Company	5	1,110	210
Bean Shipbuilding Company	1	1,100	360
McKie Shipbuilding Company	1	922	1,600
Barbare Bros.	14	814	1,400
Arthur D. Story	4	738	400
Francis Cobb Company	1	578	800
F. S. Bowker & Sons	1	565	....
Sawyer Bros.	1	435	....
Bath Iron Works	3	399	8,500
Townsend Marine Railway & Construction Company	2	280	420
Dubuque Boat & Boiler Works	3	234	105
W. F. Stone	4	220	282
W. & A. Fletcher Company	1	210	600
William H. Baldwin	2	197	40
Cowles Shipyard Company	2	70	125
Mathis Yacht Building Company	8	....	....
John H. Mathis Company	4	....	....

MERCHANT VESSELS NOW UNDER CONSTRUCTION

	No.	Gross Tons	H. P.
Union Iron Works	26	177,128	73,600
New York Shipbuilding Company	17	104,501	46,650
Newport News Shipbuilding & Dry Dock Company	13	94,529	33,100
Bethlehem Steel Company (Maryland)	15	93,007	35,950
American Shipbuilding Company	28	92,900	36,900
Pennsylvania Shipbuilding Company	10	92,000	....
Chester Shipbuilding Company	14	71,500	....
Fore River Shipbuilding Company	10	66,544	30,400
J. F. Duthie & Co.	7	61,600	17,500
Willamette Iron Works and Northwest Steel Company	7	61,600	....
Harlan & Hollingsworth Corporation	13	60,744	33,830
Standard Shipbuilding Company	8	58,400	20,000
Great Lakes Engineering Works	12	54,150	19,900
Wm. Cramp & Sons Ship and Engine Building Company	8	53,810	36,000
Skinner & Eddy Shipbuilding Corporation	9	53,580	22,500
Columbia River Shipbuilding Corporation	6	52,800	15,000
Seattle Construction & Dry Dock Co.	10	49,850	27,500
American Bridge Company	92	47,616	....
Tank Shipbuilding Company	27	47,500	....
Moore & Scott Iron Works	5	45,300	12,200
Texas Company	4	40,000	....
Baltimore Dry Dock & Shipbuilding Co.	9	29,745	12,700
Toledo Shipbuilding Company	7	19,250	9,500
Manitowoc Shipbuilding Company	9	16,856	8,980
Pusey & Jones Company	13	13,300	....
Staten Island Shipbuilding Company	6	12,600	....
Gray's Harbor Shipbuilding Company	5	12,500	3,500
McEachern Ship Company	6	10,200	3,360
Washington Shipping Corporation	4	10,000	1,920
Palmer Shipbuilding Company	4	10,000	....
M. M. Davis & Son	8	9,900	....
Brunswick Marine Construction Corp.	5	9,550	....
American Car & Foundry Company	10	8,892	....
St. Helens Shipbuilding Company	4	6,200	2,240
Coastwise Shipbuilding Company	6	5,820	....
Columbia Engineering Works	5	4,950	2,400
Peterson Shipbuilding Company	4	4,700	1,250
Bean Shipbuilding Company	3	4,000	....
W. F. Stone	2	3,600	2,000
Mathews Shipbuilding Company	2	3,600	1,280
Harlon Dry Dock & Shipbuilding Co.	1	3,500	....
Kelly-Spear Company	2	3,204	....
Atlantic Coast Company	2	3,200	....
Merrill-Stevens Company	6	3,175	1,800
Percy & Small	2	3,000	300
Kruse & Banks	3	2,400	2,000
Francis Cobb Company	3	2,340	....
Tampa Foundry & Machine Company	1	2,000	1,000
Spedden Shipbuilding Company	5	1,645	3,650
W. & A. Fletcher Company	2	1,612	6,400
G. G. Deering Company	1	1,600	....
Peninsula Shipbuilding Company	2	1,600	....
Sandifer-Clarkson Shipbuilding Company	1	1,600	480
Georgia Shipbuilding Company	1	1,350	....
G. A. Gilchrist	1	1,200	....
Sharpstown Marine Railways Company	1	1,150	....
Hillyer, Spearing & Dunn	1	1,100	....
Dubuque Boat & Boiler Works	2	1,070	200
Townsend Marine Railway & Construction Company	1	1,000	....
Bath Iron Works	1	910	8,400
E. J. Tull	1	900	....
Howard Shipyards Company	3	800	925
Arthur D. Story	3	765	1,150
Brunswick Shipbuilding Company	1	750	....
B. P. Lanteri	1	739	300
F. S. Bowker & Sons	1	550	....
Sawyer Bros.	1	500	....
Jas. Rees & Sons Company	1	460	....
William H. Baldwin	1	101	....
Cowles Shipyard Company	1	95	350
Barbare Bros.	30	....	1,500
John Wilson Shipbuilding Company	32	....	....

TABLE II.—NAVAL CONSTRUCTION

VESSELS BUILT IN 1916

Newport News Shipbuilding & Dry Dock Company	1	31,400	32,400
Fore River Shipbuilding Corporation	10	7,160	51,000
Wm. Cramp & Sons Ship and Engine Building Company	3	3,290	54,000
Bath Iron Works	1	1,075	16,000

NAVAL VESSELS NOW UNDER CONSTRUCTION

Newport News Shipbuilding & Dry Dock Company	3	97,200	102,000
New York Shipbuilding Company	2	32,640	35,000
Fore River Shipbuilding Corporation	21	16,630	224,000
Seattle Construction & Dry Dock Co.	5	9,935	20,000
Bath Iron Works	6	6,776	132,800
Lake Torpedo Boat Company	8	4,400	....
California Shipbuilding Company	6	4,190	1,300
Wm. Cramp & Sons Ship and Engine Building Company	2	2,250	37,000

year. The activity is more clearly shown by the figures in Table I which cover the work up to the end of the calendar year 1916.

On July 1, 1916, there were building or under contract to be built in the United States 385 steel vessels of 1,225,784 gross tons, of which 195 of 1,037,103 gross tons were ocean steamers, each of 1,000 gross tons or over. In British yards on the same date 432 steel steamers of 1,538,640 gross tons were under construction, but the rate of progress in such construction was much reduced. The effect of this reduced output from British yards is evident when it is remembered that while at the beginning of the calendar year 1915, 1,627,316 gross tons were under construction in British yards, yet only 650,919 gross tons were launched from British yards during the year. Since late in the spring of this year, however, British shipyards have been engaged more actively in the work on unfinished merchant ships, more than doubling the output of the earlier months.

Although the total construction of merchant vessels by American shipbuilders for the fiscal year ending June 30, 1916, as reported by the Bureau of Navigation is not large, nevertheless the tonnage of ocean-going steel steamers is the largest recorded, and it is particularly to be noted that virtually half the year's product is already engaged in foreign trade. American registered steel steamers in the competitive foreign trade have increased from 1,262,159 gross tons in 1915 to 1,498,587 gross tons on June 30, 1916, a gain of nearly 20 percent against a gain of about 100 percent under the more favorable conditions of the previous fiscal year. While many vessels formerly engaged in domestic commerce have been placed in foreign trade, little has been done to replace these vessels in American domestic service, consequently it is probable that the demand for such vessels will be felt by American shipbuilders long before the present shipbuilding boom is over, and in this way the period of activity in American yards will be prolonged as the present capacity of the yards is practically booked for at least two years to come.

As matters now stand, American shipping in foreign trade has more than doubled in the last two years—a

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

growth without precedent in the history of any maritime nation. According to the Bureau of Navigation, the increase has been in one form of employment of American ships rather than in the total shipping under the American flag. During the past two years the total American shipping has increased only 540,961 gross tons, while American shipping in foreign trade alone has increased 1,115,563 gross tons. Whether this change in the employment of American shipping will be permanent is largely a matter of conjecture, but the immediate effect of the change can only be an increased demand for new tonnage by American shipowners for both domestic and foreign trade.

Shipbuilding on Puget Sound

The Skinner & Eddy Corporation of Seattle has a building programme which includes twenty ships. Three of these are tankers for the Standard Oil Company which are being built under the Isherwood patent. The other seventeen are cargo carriers of the general plan described on page 431 of our September issue. Seven of these ships have been sold to B. Stolt Nielsen, two having been already delivered.

The first of these, the *Niels Nielsen*, met with an accident on her first trip while under charter to Mitsui & Co. en route to Vladivostok. When about 400 miles out from Cape Flattery one blade broke off her propeller. Captain Dietrickson thought it would be safer to return to port. He ran into a storm the second day and the strain was so great that about a hundred miles from Flattery the other three blades were stripped. A wireless call brought the tug *Goliah* from Seattle, which picked the *Nielsen* up after she had drifted within sight of the breakers on Vancouver Island.

The *Nielsen* was towed to Victoria, where she was surveyed by divers at the Esquimalt shipyard. A wood box was built to fit around the stern, and after this had been fitted and pumped out a new wheel was put on. The first survey was made December 3 and the job was completed and the ship put to sea on the morning of December 12. The building of the cofferdam saved unloading the cargo.

The propeller was designed by Captain Dyson, of the American Screw Propeller Company. It was 16 feet 8 inches diameter, with a little over 14 feet pitch. The turbine that drives it develops 2,500 horsepower. The blades all broke close to the hub and one of them showed evidences of cooling strain which semi-steel is apt to have.

The *Hannah Nielsen*, sister ship to the *Niels Nielsen*, has been chartered by Andrew Wier & Co. for a period of six months at 35 shillings. Since the charter includes the proviso that the ship shall not be sent to European waters the rate is more out of the usual. The normal rate for such charters is about 31½ shillings.

The method of handling material used at the Skinner-Eddy plant is being adopted at the other yards in the course of construction, and the naval constructor at the United States navy yard at Bremerton is considering installing it there. It consists of a trolley run on a cable suspended between posts at each end of the ways. There are three of these cables, one over the centerline and one at each side. They are served by thirty horsepower drum electric winches. The masts are well anchored and the strain on the cable does not make a noticeable sag. Two trolleys are generally used, and with the centerline trolley and one of the side trolleys material can be laid down on any part of the ship.

The Seattle yards are finding this system as efficient for handling material as other systems and much cheaper to install than overhead cranes or locomotive or gantry cranes on built-up tracks. They need not interfere with sheds where sheds are built over the ways, and the sheds can be built much lighter than when they are used as support to traveling cranes.

The Seattle Construction & Dry Dock Company is enlarging its machine, boiler and blacksmith shops and installing a system of overhead trolleys to handle material over the machinery. The big shed that was built to cover the battleship *Nebraska* has been taken down, and for the present at least work will be in the open. The pole trolley system for handling material over the ways has been installed. There are six working ways at present and two more are under construction.

At present there are about 2,500 men employed, but as soon as work is started on the scout cruiser which they recently contracted to deliver to the United States government in thirty months this number will be increased to more than 3,200.

J. F. Duthie & Co. is one of the recently organized shipbuilding companies that are establishing new yards in Seattle. This company has contracts for seven steel freighters for Norwegian interests and is building a permanent plant on the East Waterway. They will employ about 1,500 men when the yard is finished and work on the ships begins, which will be about the first of January. They have constructed three building ways. They will not establish a machine shop or boiler shop at present, but will buy their boilers from the Commercial Boiler Works, of Seattle, and the turbines with which their ships will be powered will be bought in the East.

C. D. Bowles is the president of this new company, and J. F. Duthie is vice-president and general manager. The ships for which they have contracts will be freighters of the spar deck, raised forecastle, bridge and poop deck type. They will be 423 feet long overall, 54 feet beam, 29 feet 9 inches deep, 10½ knots speed and have a cargo capacity of 8,800 tons.

The Ames Shipbuilding & Dry Dock Company is building a new plant on the West Waterway in Seattle. They have contracts for three steel freighters about the same size and type as those of the Duthie yard. This yard will also enter the engine and ship repair business and they will build an 8,000-ton dry dock as part of their equipment. They will have three building ways.

The officers of this company are Edgar Ames, president; David Hollywood, general manager; George W. Albin, secretary, and J. V. Patterson, formerly with the Seattle Construction & Dry Dock Company, consulting engineer.

Captain John L. Anderson has secured contracts for two 8,800-ton freighters and will increase the size of his plant, near Kirkland on Lake Washington. The completion of the government locks between Puget Sound and Lake Washington make possible the development of this yard, which has been used to build boats for the lake service.

The Washington Shipping Corporation has four 252-foot four-masted wood auxiliary schooners on the ways, and their present building schedule calls for eight more. Their first ship will be launched in the next thirty days.

All yards on Puget Sound are finding steel deliveries slow and expensive. The sudden increase in shipbuilding has made a shortage in all lines of supplies. The shipbuilders are fighting an increase in freight rates, as the increased tariffs which have been filed by the carriers of the Northwest will put them out of business. Henry W. Thurtell, examiner of the Interstate Commerce Commission, held a hearing in Portland December 12. The present rate on structural steel is 65 cents (2/8½) a hundredweight, and the new tariff is 75 cents (3/1½).

Generated on 2024-08-12 19:56 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Trouble with Air Pump on Jet Condenser

Air pumps, as a rule, do not give much trouble and require little care. Only once have I experienced real trouble on an imitation Edwards pump in a stationary power plant. The pump was independent steam-driven and connected to a jet condenser. It had a flat piston, Fig. 2, in place of the conical piston, Fig. 1, of the Edwards pump, and this I think was mostly responsible for our trouble, the breaking of the pump rod. The flat end of the piston hit the water on the downward stroke with a loud report and only by throttling the suction valve, which in turn lowered the vacuum, could this be reduced.

This pump may have given fairly good service in connection with a surface condenser, to remove condensate and air only, but it did not in connection with the jet condenser. In fact, I believe that no Edwards pump should be used with a jet condenser, because the inrushing water interferes with the action of the pump. But the Edwards pump has all the merits of a good surface condenser air pump and may well leave the jet condenser to other types of pumps.

As a marine engineer, I don't care for jet condensers, and I could discover no reason why in this particular plant a jet condenser was installed. There was ample room for a surface condenser and the fresh water found on the property was no good for boiler feeding and was almost as expensive as city water.

After several bronze pump rods snapped off within a short time, a nickel steel rod was used with good results; that means the rod did not break during the time I was employed there, and I had no opportunity to examine the pump to find the effect of galvanic action due to the salt cooling water.

A, B. C (Fig. 1) is a good rod packing for Edwards pumps. *A* is a flat packing ring of any not too soft packing. Material *B* is a white metal ring with a number of grooves in the bore. This ring should be in one piece and as high as possible, leaving room only for two soft packing rings *C*. These hemp or cotton packing rings should occasionally be soaked in hot tallow with graphite. Very little oil should be used with any packing on this rod, because the oil will be drawn into the pump very soon. With this packing, keep a little fresh water on top of the gland. This will help filling the water grooves in ring *B*, and if the water disappears too soon, tighten up a little on your gland.

D is ordinary cord coated with white lead; lay it on the flange as in Fig. 3. It is good and cheap packing for the pump head and the head valve plate.

Newport News, Va. H. G. KLUNDER.

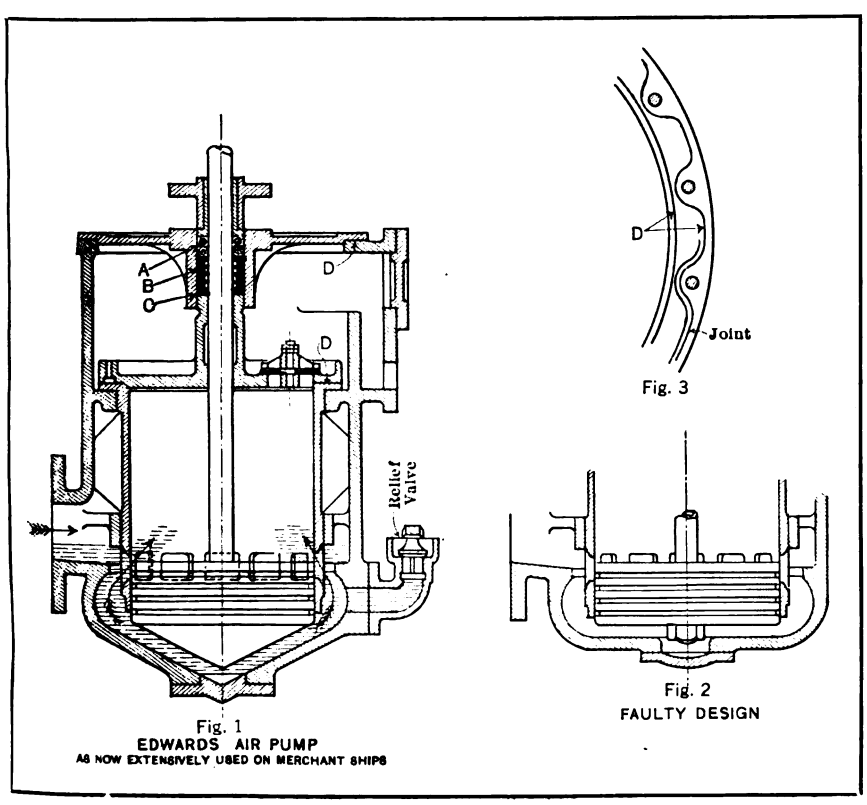


Fig. 1
EDWARDS AIR PUMP
AS NOW EXTENSIVELY USED ON MERCHANT SHIPS

Fig. 3

Fig. 2
FAULTY DESIGN

Sections of Air Pumps, Showing Cause of Failure

A Visitor's Comment

After reading N. G. Near's article, "A Poor Combination," in the December issue, page 554, I am tempted also to give a personal opinion. I feel that after the kind of courtesy given by the engineers of the boat that he inspected he shows poor thanks in criticising the chief and assistant.

He is no doubt a stationary engineer, and does not take into consideration that marine engines are not secured to bed rock foundations and that a noisy marine engine is not always a symbol of slackness in the care of it. Even after a thorough overhaul and refitting of all moving parts, the first trip that the boat makes in heavy weather (or should she happen to bump the dock a few times at either end of a trip) will develop a pound or two in some of the bearings.

Another thing, marine engines of steamboats that take people on their vacation trips are generally pretty busy and refitting bearings is accomplished in between trips, and not always a first class job can be done. The owners generally demand to keep her a-going. Perhaps N. G. Near expected that the engineer of the watch would stop the engine, take the bearings apart and show him where and what

Generated on 2024-08-12 19:54 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

caused the knock. Should a visitor show cheek enough to ask where the knock was in an engine of my plant, I would tell him the same thing, "In there."

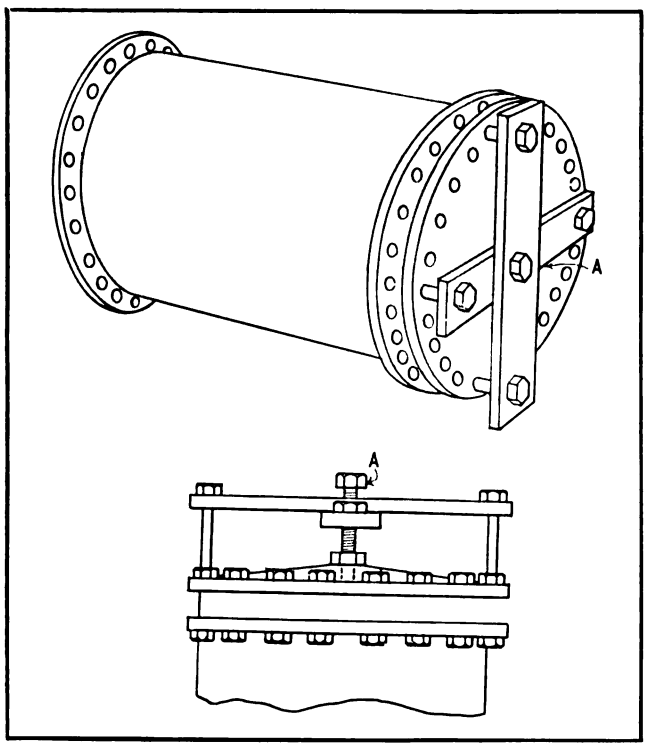
N. G. Near says that the assistant leans too heavy on the chief, and that he knew but little, as he could not answer some of the simplest questions. If he considers that talks on the relative efficiency of the engine and why the owners did not install turbines in place of reciprocating engine are simple questions, then he himself must be well educated. I think that the first assistant realized that he had an extra inquisitive visitor and that he shut him off with short answers.

Criticisms like that of N. G. Near are no doubt the reason that more visitors of his type are not welcomed into the engineers' department of a steamboat.

C. H. W.

Staying a Feed Water Heater

Constant trouble was caused by the movement of one of the heads of our low pressure feed heater. It would pulsate like a diaphragm with every stroke of the lift



Remedy for Leaky Head of Feed Water Heater

pump when the pressure got over 25 pounds, and even with a pump governor this would happen.

This pulsating of the head caused it to leak at the joint and around the bolt heads. To remedy this, I used two pieces of 1½-inch by 3-inch steel stock (in the manner shown in the illustration), taking out four bolts and putting in four longer ones to hold the straps, drilling and tapping a hole through their center for a 1¼-inch bolt.

Setting this up against the center of the head cured the trouble.

W.

Care of Marine Boilers

Boilers are the most expensive and perishable parts of the machinery of a steamship, often requiring to be replaced twice, and sometimes three times, during the life of a vessel. Deterioration and decay begin as soon as the boilers are put in use, and are only partially prevented by care on the part of designers and engineers. At the present time the demand for large and fast steamships necessitates the use of boilers of great size and cost. The attention of builders and owners is therefor directed to keeping this portion of the machinery up to the highest point of utility for the longest period at the least expense.

Twenty years ago eight years' work was considered a good average for a marine boiler, but the period of usefulness has been increased about 100 percent in recent years. This gain is due in a measure to the improved design and construction; but more probably to the more intelligent care bestowed upon them by modern engineers.

The first and simplest thing to guard against is external corrosion. This arises from various causes, drips from leaky decks, leaky screw staybolts, leaky handhole plates, joints, stuffing boxes, etc., and from a cause so apparent that it would not be noted if it did not occur so often, namely, the neglect to waterproof portions of the boilers directly under hatch openings.

There is no good reason for the existence of any of these causes of corrosion, yet they do exist and create a constant demand for the "soft patch." The most serious point of external corrosion is the front of the ash pit and the adjacent portion of the boiler head. The use of fire tools, wetting down of ashes and other causes conspire to render corrosion at this point very rapid.

It may be counteracted in part by the persistent use on the ash pit fronts of the waste oil and grease from the engine room. A better method of protecting this part of the boiler, though seldom applied, is to fit soft patches or wearing plates of 5/16-inch iron over the seams connecting the furnace to front head, and extending over the lower part of the front head to take in the front seam of the shell. This should be done when the boiler is new, and, although these wearing plates will last only a few years in active service, their renewal is simple and inexpensive; therefore, to be strongly recommended. Four years' wear in hard service has been obtained from the wearing patches by keeping them smeared with the waste oils from the engine room.

With ordinary intelligence bestowed upon the care of marine boilers, there is no reason why their period of usefulness should be shortened by external decay. Internal decay is a much more serious matter. The chief causes of trouble inside boilers are use of dirty water, greasy water, cold feed water, imperfect circulation and contracted water spaces. Using steam at a pressure of 160 pounds per square inch involves difficulties that did not exist at 75 pounds per square inch. At the latter pressure a little supplementary feed from the salt water inside of the condenser would give a coating of lime inside the boiler, prevent pitting and the oil coming with the feed water would rapidly rise in the slightly brined water to the surface and could be cared for by the scum valve, but while a sixteenth of an inch scale on a back tube plate would not cause trouble at a working pressure of 75 pounds per square inch, at 160 pounds another condition of affairs exists. The tube plates having been thickened for increased temperature, the tube ends will leak from a very slight deposit on the tube plate.

A spray from a leaky tube end, wetting the particles of ash, coal and dust carried by the draft, forms a deposit on the other tube ends and the furnace is rendered useless. If two furnaces are common to one chamber, both are disabled; much disagreeable labor is entailed expanding leaky tubes, and this must be done repeatedly until there is an opportunity to thoroughly clean the boilers.

There is also danger under forced combustion of the tube ends leaking enough to cause a back draft from the furnace into the fire room.

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Corrugated furnace crowns are seriously injured by even thin scale, and it will be found that corrugations near the middle of the grate suffer most. At this point the repeated opening of the furnace doors and consequent change of temperature causes the scale to crack, a new coating is formed, is again cracked, and so on repeatedly until, in some cases which have come under the author's observation, the scale for twenty days' run had formed in leaves attached to corrugations like the leaves of a book to the binding with the open edges of the leaves, about one inch over all, toward the front of the furnace, and the attached edges about ⅛ inch thick toward the back. This shows that the evaporation is much greater at this part of the boiler. In parts of the boiler where less active generation of steam takes place, pitting is sure to follow. The under sides of boiler tubes suffer most, also the sides of furnaces about the line of the grate bars, and sides and bottom of combustion chamber. The pitting in these places is rapid and frequently unobserved in the earlier stages, the pitted parts being covered with black, moderately hard oxide, which, being removed by thorough washing and scraping, discloses the true condition of the metal attacked.

To prevent this overheating and pitting, from the presence of oil or grease, many remedies have been used with varying results. Filters of various kinds are among the most successful devices, sometimes applied on the suction side and sometimes on the discharge side of the feed pumps. These filters are of various metals; sponges, blankets, coke, charcoal, gunnysacks, horsehair, tan bark, hay, etc., each being strenuously advocated by its particular selling agent, but the results depend more upon the care and judgment exercised by the engineer than upon the material of which the filter is made.

The filter which presents the greatest surface in a given space, which can be readily replaced, and the material for which can be obtained at any port at small cost, will commend itself to engineers; but a filter tank filled with ideal material will mechanically trap only a small percentage of grease if the fitering material is not frequently cleaned or renewed.

The designer of a filtering tank should bear in mind that the location, accessibility and facility with which covers and interiors can be removed and replaced is of vital importance.

Efforts have been made to catch the grease in the main engine exhaust pipes, hoping thereby to keep the condenser as well as the boilers clean, but reports are conflicting as to the success of these devices. Feed water heating arrangements assist materially in getting rid of the grease. Cold feed water is injurious to boiler shells, furnaces and furnace seams, and feed water should be heated to within a few degrees of the steam temperature before being discharged into the boiler; but while this is generally done, it is, strange to say, not a universal practice. Heating the feed water by direct contact with steam is so simple and satisfactory that it seems to meet all requirements.

Efforts have been made to neutralize the effects of oil in boilers by injecting sal soda, caustic soda, lime water and potash with the feed water; but, as the best cylinder oils now in use are pure mineral oil and do not saponify, the results have not been satisfactory.

Zinc slabs in parts of the boiler showing decay seems to retard it somewhat, though a large quantity, sometimes amounting to tons, has been used without satisfactory results.

It will be found that boilers fed by an independent feed pump with feed water from a surface condenser, aided by an evaporator, filter and heater, have very little tendency to pit below the line of the grate bars when an efficient system of mechanical circulation is maintained. The use of hydrokineter warms the water in lower parts of boilers when getting steam, but constant circulation is necessary, especially under banked fires, and the water should be pumped continually from lower front end of boiler to upper back end.

The value of this simple method is greatly underestimated, and on many vessels the pumps are not fitted up for the purpose. Constant circulation by pumping prevents the lower shell seams being strained by unequal expansion and reduces pitting below the grate line to a minimum. The benefit derived from constant circulation below the grate level seems apparent when we consider how little pitting takes place between the grate line and top of combustion chamber. In two-furnace boilers pitting below the grate line is greatly in excess of that in three-furnace boilers, a difference due to the better circulation maintained in the latter by the location of the middle furnace.

If tubes are placed too close together, cleaning is difficult and tubes are liable to be burned at the back ends from an insufficient supply of water to tube plates. Tubes placed to give 50 percent water surface to tube plate give practically no trouble, but if placed to give only 40 percent are likely to make the water in boilers foam and give needless trouble to keep back ends of tubes tight in top sheets.

When the tubes are overcrowded in boiler various methods are resorted to, such as ferrules and cements, to prevent leaking of tube ends. However, all such devices are merely temporizing with the difficulty, which exists primarily in the defective design.

On the flame side of the furnace decay takes place at the point of contact with the brick wall, and as the deterioration covers a large surface it is apt to escape detection until the plate is quite thin. By placing thin sheet iron between the bricks and the furnace plate each time the bridge wall is rebuilt the decay may be retarded. Around the manhole joint in the interior surface of the plate pitting occurs partly from the presence of sulphur in the rubber gaskets and partly from rapid buckling upon the surface of the plates.

The wear of boilers depends much upon the character of the service in which the vessel is employed. Tug boats, bay steamers and coasters, in the order named, seem to suffer more than ocean steamers. Irregular application of heat, lying under banked fires for long periods and irregularity of washing out boilers will account in a great degree for this difference

The care of a marine boiler when not steaming is of great importance. If empty, it should be quite dry. If it contains water it should be quite full and have no leaks. Sudden stopping of engines, without an independent air pump to care for the steam, is a constant source of injury to boilers, as it is difficult to check the pressure without notice. There is, of course, no difficulty with independent air pumps to care for the steam.

The use of forced draft has added to the difficulty of caring for boilers, especially with the closed fireroom system, as the admission of cold air when the fire doors are open is the worst possible treatment for back connections and tubes. The induced-draft system is little, if any, better, either with the fan or the jet in the smokestack. The alternate high and low temperature from the immense heat of the fires and the inrush of cold air when the fires are replenished demand a very elastic duty from materials and conditions that are the reverse. Forced draft with the closed ash pit system affords better control of the steam-making power and depends less upon the trim of ventilators or direction of the wind, especially in the tropics, where fireroom duty is always severe. It is also free from the great objection of admitting a rush of cold

Generated on 2024-08-12 19:53 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

air when the fires are replenished. The main objection to its use is increased length of fireroom required with the ordinary type of marine boiler, but its use in moderation is extending and all the appliances to supply it are of the most permanent and durable character.

This system does away with the difficulties arising from handling coal from different bunkers and discharging ashes which are encountered with a closed fireroom, and the longest voyages may be made with a regularity of steaming impossible with a closed fireroom or natural draft.

The foregoing remarks apply particularly to the ordinary type of marine boiler, but of late years the demand for high pressure and less weight per horsepower has brought into use various forms of watertube boilers, the care of which is important. All that has been said as to the necessity of supplying pure water is more imperative with the watertube boiler than with the older type. Being more flexible, the watertube boiler suffers less from forced draft with closed fireroom, but, being more susceptible to change of temperature and having a small storage of water, will suffer greater loss from a steam-making standpoint than if used with the closed ash-pit system.

The life of grates, bridge walls, furnace fronts, depends almost entirely upon the coal used. With Pacific Coast, Australian, Japanese, Chilean and the lower grades of English and Scotch coals, the furnace fittings wear well, the linings of the fronts suffering most when the fire is too near the front. With good grades of Welsh and Pennsylvania coal the wear is much greater, especially if dampers are used suddenly to prevent blowing off steam when it is necessary to stop the engine quickly.

The most used grate bars are the thinnest, and wrought iron is preferable, as this can easily be straightened or pieced out aboard ship, when cast iron ones might not be obtainable.

Breechings, front connections and doors require constant attention when lignite or flancing coal is used, and if not kept in repair add to the consumption of coal and interfere with the draft. With patching and repairing, front connections, doors and uptakes will usually last as long as the boilers; not so with the smokestack. In active service, ten years is a long life, and this again depends on the quality of coal used. If flaming coal is used the smokestack has a very short life—not more than five years with some of the lignites.

The outside of the smokestack is protected by paint, but as yet we know of nothing that would afford real protection to the interior. Some vessels are provided with hoods to protect the smokestack when laid up, but these are seldom used when the vessel is in commission.

It is the custom of recent years to cover the greater part of boiler shells with non-conducting material, covering this in turn with either sheet lead, galvanized sheet iron or painted canvas. If either of these waterproof coverings are permitted to leak the non-conducting material, being porous, absorbs the moisture and causes corrosion. There are numerous non-conducting coverings which, when properly put on and kept waterproof, which is seldom, will last as long as the boiler.

Bottom and surface blow-off valves and feed check valves require constant attention. The scour from the blow-off is particularly bad on the seats of the blow-off valves, and if neglected and permitted to leak entail serious trouble with blow-off pipes. These valves should be ground in or faced up frequently. In using the blow-off at sea, the gradual and the simultaneous closing of outboard and inboard valves will greatly reduce wear on pipes. In these pipes the dynamic effect of the sudden change from cold water to hot pressure and the reverse is very great and will sometimes split the heaviest pipes.

The gage cocks must of necessity be blown through to keep them free, and if the composition contains zinc they last but a short time. The author has renewed them after but three months' wear, when the keys looked more like sponge than metal.

Boilers well designed, constructed of the best materials and equipped with the most approved fittings may be a source of constant annoyance and expense for the lack of intelligent care in the matter of raising steam and blowing off the water. If boilers and pipes are slowly and equally warmed before pressure is raised a most fruitful source of leakage is avoided.

When at the end of a voyage steam pressure is blown off, dampers and doors should be closed and the water left in the boilers to cool gradually, a couple of days if practical, before being pumped out. Attention to these details will be well repaid by the absence of leaks, which are inevitable when boilers are blown out with steam pressure.

The length of time a boiler may be used varies so much under different conditions that it is difficult to arrive at a satisfactory average. The author can recall two sets of boilers of the same type and in similar service, one set of which was renewed after eleven years of service. These boilers were steam tight, and from the furnace side were apparently as good as ever. Yet the back connection sheets were found to have been reduced in thickness by decay from three-quarters of an inch to barely one-half an inch. Where decayed, the combustion chamber had only about a two-inch space between that and the shell.

The other set of boilers, having 3½-inch to 4-inch water space around combustion chamber, was found to have worn very little at these points, and was continued in use four years longer.

Another marked instance has come under the author's observation where the machinery of two vessels on the same service shows marked difference in wear. The boilers in one vessel required renewal after seven years of service, while in the other they have now been running sixteen years and appear to be good for many years more. In the latter case the same chief engineer has had charge of the machinery from the beginning of service.

Among the many old boilers which the author has seen repaired he has found that as a rule comparatively little decay has taken place above the bridge walls, and the shells were pretty good except the lower parts, but the furnace lower back connection and lower stays often made me wonder how it was possible for the parts to hang together and stand the pressure test.

With the superior quality of steel available for the construction of boilers at the present time drilled holes, improved workmanship and the use of corrugated and other elastic furnaces, the life of boilers are much longer than some years ago. Evenly distributed bracing, tube space not crowded, the use of hot filtered feed water and mechanical circulation of water in boilers, with the renewal of tubes, etc., have prolonged the life of marine boilers to nearly twenty-five years as a general thing.

Eternal vigilance is the price of safety in the case of steam boilers, and the engineer who despises small things will be continually beset with small troubles, which in the aggregate will greatly reduce the period of service of boilers and engines.

EDWARD B. FRASER.

MONTHLY SHIPBUILDING RETURNS.—November, 1916, was the record month for American shipbuilding, according to returns of the Bureau of Navigation, Department of Commerce. During this month, American yards completed 90,636 gross tons, all officially numbered for the American flag except two steamships of 7,847 gross tons for Norwegian owners.

Generated on 2024-08-12 19:32 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

CONDUCTED BY H. A. EVERETT *

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so. Indicator cards taken from marine engines will be carefully analyzed, and defects pointed out, and the horsepower calculated, provided complete data are sent with the cards.

Calorific Value of California Crude Oil

Q.—What is the calorific value of California crude oil as used for boiler fuel? Is it better than Texas oil? O. F.

A.—California crude oil runs about 18,500 B. T. U. It varies from the different fields from about 18,300 to 18,700. Beaumont crude has a little higher calorific value; 19,000 to 19,500, and a slightly less specific gravity.

Mechanical Efficiency and Fuel Consumption of Small Gasoline (Petrol) Engines

Q.—What are reasonable mechanical efficiencies and fuel consumptions for a four-cycle gasoline (petrol) engine of about 25 brake horsepower and for a two-cycle engine of 12 brake horsepower? M. C.

A.—For the four-cycle engine 85 percent and .6 pound of gasoline (petrol) per brake horsepower are reasonable, and for the two-cycle engine about 80 percent and .9 pound of gasoline (petrol) per brake horsepower per hour.

Calculations for Hydraulic Punch

Q.—Please give me some information through your valuable column of "Questions and Answers" of the latest hydraulic punching bars, with diagrams, if possible, and kindly work out for me the thickness of cylinder and its diameter, the length of the different internal and external levers and the diameter of ram. I must point out that the maximum diameter of punch and thickness of plate are ⅞ inch and ¾ inch respectively.

How much is counted the shearing force for punching per square inch? Of course it will be much greater than the shearing force used for ordinary calculations.

Is there any really valuable book you could point out to me dealing with strength of materials and having practical examples of daily use worked out? M. C.

A.—The resistance to punching is commonly considered as 1.7 times the theoretical resistance to perfect shear; this results for this case in the following expression:

$$P = W \pi d t$$

where P = maximum resistance to be overcome,
W = 1.7 × shearing strength (for mild steel plates and shapes 1.7 × 50,000 = 85,000),
d = diameter of hole in inches,
t = thickness of plate in inches.

For a diameter of ⅞ inch and thickness of ¾ inch this results in a force of $P = 85{,}000 \times \pi \times \frac{7}{8} \times \frac{3}{4} = 175{,}000$ pounds; with allowances for friction this might be taken as 200,000 pounds.

A ram cylinder of 5-inch diameter would be about right for this case; then the maximum pressure in cylinder will be

$$\frac{200{,}000}{\frac{\pi \times (5)^2}{4}} = 1{,}020 \text{ pounds per square inch.}$$

For thick, hollow cylinders Merriman quotes the following formula to estimate thickness required:

$$t = \frac{r \times p}{f_t - p}$$

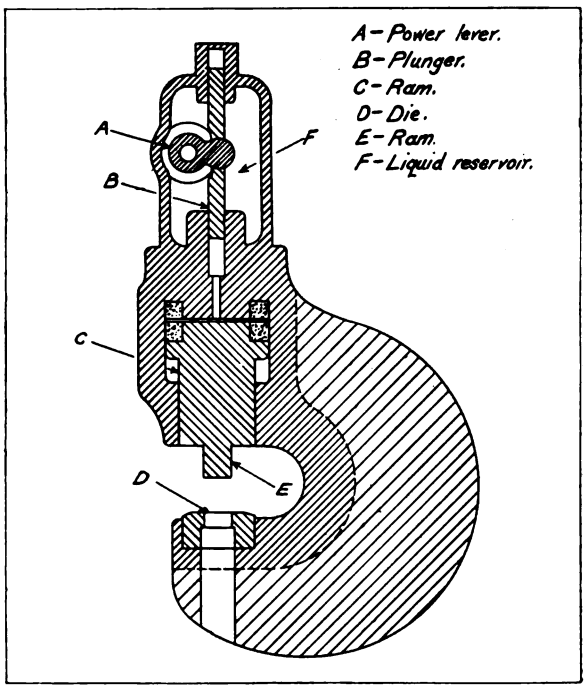
t = thickness in inches,
r = radius to inside of cylinder,
p = pressure in pounds per square inch,
f_t = working strength of material used.

For cast iron f_t = 3,000 is a reasonable value, and using this

$$t = \frac{2.5 \times 1{,}018}{3{,}000 - 1{,}018} = 1.285,$$

or a little over 1¼ inches.

The stroke should be from two to three times the thickness.



Section of Hydraulic Punch

Using a stroke of 2.5 inches, the piston displacement of ram is

$$\frac{2.5 \times \pi \times 25}{4} = 49.2 \text{ cubic inches.}$$

Assuming a diameter of pump plunger of ⅝ inch and a stroke of 3 inches, the maximum pressure on the plunger is .307 × 1,018 = 312 pounds, and the number of double strokes for 1 inch of travel is

$$\frac{49.2}{2.5 \times 3 \times .307} = 21.3.$$

Assume point of application on piston 3 inches from fulcrum, 30-inch lever; then force necessary at end of pump handle is

$$\frac{3}{30} \times 312 = 31.2 \text{ pounds maximum.}$$

Valves, passages, springs, etc., and their design are governed by good practice, rather than by fixed rules.

* Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

Generated on 2024-08-12 19:16 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Sufficient space must be left in head for more than maximum amount of liquid necessary. This is to cover leakage, to provide a liquid "head" on suction valve, and to prevent air leakage below piston.

Below is given a diagrammatic sectionalized figure to facilitate following the computations.

Unwin's "Machine Design," Part I, is excellent for strength of materials and fundamental design conceptions. It has not very many illustrative examples, however.

Effect of Change to Valve Gear

Q.—What will be the effect on the valve action of a steam engine if the eccentric has a small turning taken off its face to true it up? V. G.

A.—The same effect as shortening the valve stem by the amount of the chip taken off. The eccentricity remains the same, therefore the travel of the valve, but the valve will be bodily displaced toward the crank by the amount of the cut.

Propeller Problem

Q.—What sized propeller should I put on a vessel which is to make 18 knots, on a shaft horsepower of 1,200 with the main engine turning at 150 revolutions per minute? K. T.

A.—The question has insufficient data to permit of the determination of the best propeller, but *a* propeller which would do the work provided cavitation were not encountered is: Diameter, 10 feet; pitch, 10.63 feet; number of blades, 3; projected area, 19.1 square feet; developed area, 23.2 square feet.

Specific Heat of Water

Q.—Does the specific heat of water change apreciably at higher temperatures and pressures? E. T. P.

A.—At 60 degrees F. and atmospheric pressure it is unity. At the following temperatures and pressures it has increasing values:

T	*P*	*Specific Heat*
300	67	1.029
350	135	1.045
400	247	1.064
440	381	1.082

Lubricating Oils

Q.—Can you give any suggestion or references that will be helpful to me in the selection of lubricating oils? I have a meager technical equipment consisting of hydrometer, viscosimeter and flash point determining apparatus, and have to purchase considerable quantities of lubricating oils for a rather wide range of machines. L. O.

A.—Prof. A. H. Gill, in the "Mechanical Engineer's Handbook," makes the following statement:

"In choosing a lubricant, the following points should be considered: (1) The pressure on the moving surfaces, (2) the velocity with which the surfaces are moving, and (3) their temperature. The cardinal principle underlying all lubrication is to *use the least viscous oil that will stay in place and do the work.* Besides this, the following will aid in the selection of a suitable lubricant:

"1. The flash point should be above 300 degrees F.

"2. The result of an evaporation test should be under 5 percent.

"3. For light pressures and high speeds, mineral oils (of specific gravity 30.5 degrees Bé., flash point 360 degrees F.), sperm, olive and rape oils may be used.

"4. For ordinary machinery, mineral oils (of specific gravity 27-29 degrees Bé., flash point 400-450 degrees F.), lard, whale, neatsfoot, and tallow or heavy vegetable oils may be employed.

"5. For cylinder oils, mineral oils (of specific gravity 27 degrees Bé., flash point 550 degrees F.), alone or with small percentages of animal or vegetable oils (degras, tallow, linseed, cottonseed and blown rape) may be used.

"6. For watches and fine machinery, clarified sperm, jaw and "melon" oils may be employed.

"7. For very heavy pressure and slow speed, lard, tallow and other greases, either by themselves or mixed with graphite and soapstone."

Baume Scale

Q.—Why does a higher value on the Baumé scale for specific gravity mean a lower actual specific gravity? C. H.

A.—The floating tube which serves as a hydrometer has a scale arbitrarily divided to read increasing values as the immersion increases, so that the lighter liquids (specific gravity is less) permit it to sink deeper and therefore read to a higher value. It should be noted, however, that it is only when the hydrometer is used for liquids heavier than water that the readings increase as the immersion decreases.

The instrument frequently has, however, a double scale, so that it may be used for liquids of specific gravity greater or less than unity. The scale is so graduated that the readings will increase with *increasing* immersion for liquids lighter than water, and increase with *decreasing* immersion for liquids heavier than water. For liquids heavier than water:

$$\text{Specific gravity} = \frac{145}{(145 - \text{degrees Baumé})}$$

For liquids lighter than water:

$$\text{Specific gravity} = \frac{140}{(130 + \text{degrees Baumé})}$$

Net Tonnage of Engine Room

Q.—In measuring the propelling space deductions for registered tonnage, how is the net tonnage of the actual engine room obtained? Any space occupied by and necessary for the safe working of machinery not used in propelling the ship is not to be included in the net tonnage of actual engine room. It generally happens, however, that the room necessary for the safe working of such machinery is also necessary for the working of machinery which is used in connection with the propulsion of the ship, such as the air and feed pumps. Also it is probable that piping connected with machinery necessary for the propulsion of the vessel may be over and perhaps also under spaces occupied by, say, electric light engine and dynamo. Again, if machinery not used in propelling the ship were placed elsewhere than in the engine room, a larger propelling space deduction might be obtained. Is a surveyor justified in excluding from the deduction the space right up to the "crown" of the engine room over machinery not used for propelling the ship? C. O.

A.—The rule reads that when the tonnage of the actual engine room amounts to between 13 and 20 percent of gross tonnage in screw steamers the deduction allowed for propelling power shall be 32 percent of the gross tonnage. Should the actual engine room be under or over the above percentages of gross tonnage, the deduction for propelling power may be estimated at 1¾ times the tonnage of the *actual engine room* in screw steamers.

This means that the entire volume of the engine room is to be measured and used in determining the deduction from gross tonnage of the ship to obtain net tonnage. There is no such thing as net tonnage of the engine room. It has a certain actual tonnage (its actual volume in cubic feet divided by 100) and this comprises the volume occupied by the whole propelling plant clear across the ship. If machinery necessary for the safe operation of a vessel occupies a space, and that space cannot be made available for the carrying of cargo, it should be counted a part of the machinery space; air and feed pumps should be so counted. No deduction is usually made for piping. If machinery not used in propelling the ship were placed elsewhere than in the engine room and it were possible to carry cargo in the surrounding space, the surveyor is justified in refusing to include it in the deduction.

Basically, all spaces which are not available for cargo should be deducted from the gross tonnage to obtain the net tonnage; actually, the rules vary in different countries and are hampered by numerous specific limitations intended to minimize the surveyor's discretion in deciding.

Generated on 2024-08-12 19:15 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Shipbuilding and General Marine News

Contracts for New Ships—Marine Terminal Improvements—Recent Launchings—Improved Appliances—Personal Items

Progress of American Shipbuilding

Steel merchant vessels building or under contract to be built in private American yards on December 1, 1916, according to builders' returns to the Bureau of Navigation, Department of Commerce, numbered 400 of 1,428,003 gross tons. On December 1, 1915, builders' returns of construction or contracts for the construction of steel merchant vessels aggregated 202 vessels of 761,511 gross tons. The tonnage building or ordered on December 1, 1916, however, is less (17 vessels of 51,943 gross tons), than on November 1, 1916, the first break in the line of increases since the issue of these monthly returns began in February, 1916.

During November, American yards finished 22 vessels of 68,922 gross tons which had been carried in these statements, and made new contracts for 7 steel merchant vessels of 18,285 gross tons.

During the current fiscal year the builders expect to launch 294 vessels of 904,231 gross tons, and during the fiscal year ending June 30, 1918, 106 vessels of 523,772 gross tons. These dates of launching, of course, are subject to the usual allowances for delays.

Shipbuilding Contracts

The New York Shipbuilding Company, Camden, N. J., has received a contract from the Navy Department, Washington, D. C. to build two battleships to cost about $11,000,000 each.

The Newport News Shipbuilding and Dry Dock Company, Newport News, Va., will also build two battleships for the Navy Department, each to cost about $11,000,000. The displacement of all four of these ships is to be 32,500 tons each.

The Fore River Shipbuilding Corporation, Quincy, Mass., will build eight destroyers for the United States Navy.

The Union Iron Works Company, San Francisco, Cal., will build six destroyers.

The Bath Iron Works, Bath, Me., received a contract from the Navy Department some time ago to build four of the twenty destroyers authorized, and it has not yet been determined whether the remaining two destroyers will be built by contract or at the navy yard.

It is understood that the three battleships to be contracted for in 1918 will be of 40,000 tons displacement each and capable to making 23 to 24 knots.

The California Shipbuilding Company, Long Beach, Cal., will build three submarines for the Navy Department.

The Electric Boat Company, 11 Pine street, New York, will build eighteen coast and one 850-ton fleet submarines.

The Lake Torpedo Boat Company, Bridgeport, Conn., will build six coast and one 850-ton submarines.

The Portsmouth, N. H., Navy Yard will also build an 850-ton submarine.

The Seattle Construction and Dry Dock Company, Seattle, Wash., will build a 35-knot scout cruiser for the United States Navy, to cost $4,975,000. This company was the only private concern to bid on the four scout crusiers whose figure was within the appropriation of $5,000,000 each. It is stated that the Secretary of the Navy will seek an additional appropriation at the next session of Congress for the remaining three vessels. In the mantime, new advertisements for bids for the three vessels will be published by the Navy Department.

The Texas Company, Bath, Me., will build four oil tank steamers for the Texas Steamship Company, 17 Battery place, New York, in addition to the four ships, contracts for which have already been announced.

The Navy Department, Washington, D. C., is advertising for bids for the construction of an ammunition ship. Bids will be opened on January 3.

The J. F. Duthie Shipbuilding Company, Seattle, Wash., has received a contract from Norwegian interests to build another 8,800-ton steel steamship, making the seventh vessel now under contract.

The Great Northern Railway Company, St. Paul, Minn., announces that it will have four steamers built for its freight and passenger service between Seattle and the Orient. It is probable that these ships will cost about $3,000,000 each.

The Union Iron Works Company, San Francisco, Cal., has received a contract from the Atlantic Refining Company, Philadelphia, Pa., to build two oil tank steamers, to be propelled by geared turbines. This is in addition to the six steamers for which the Union Iron Works has already received contracts from the Atlantic Refining Company.

The Matthews Shipbuilding Company, Hoquiam, Wash., has received a contract from the Hart-Wood Lumber Manufacturing Company, Hoquiam, to build a steam schooner, to cost $200,000. The vessel will be an oil burner.

J. M. Somerville, Gulfport, Miss., is having a four-masted wooden schooner built to have a capacity of 800,000 feet of lumber.

I. L. Snow, of Rockland, Me., is building a four-masted auxiliary wooden schooner for the Atlantic Maritime Company.

It is reported that the Alpha Engine and Machine Works, Portland, Ore., has a contract from Danish owners to build four steamships at a total cost of more than $2,000,000.

The city of San Pedro, Cal., will hold an election to vote on $1,000,000 in bonds to build a dry dock and shipyard. Write to Mayor F. T. Woodman.

The American Shipbuilding Company, Cleveland, Ohio, has received a contract from the Atlantic Gulf and West Indies Steamship Lines, New York, for two 3,000-ton steamships, to be delivered in September and October, 1917.

The Alabama-New Orleans Transportation Company, New Orleans, La., has received a contract from the Mexican Petroleum Corporation, New York, to build four steel tank vessels for the Tampico and New Orleans trade.

The Navy Department, Washington, D. C., has opened bids for the construction of four battle cruisers. Bids were received from the Newport News Shipbuilding and Dry Dock Company, Newport News, Va.; the William Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa.; the Union Iron Works Company, San Francisco, Cal., and the Fore River Shipbuilding Corporation, Quincy, Mass. All of the bids were based upon the cost of construction, plus a percentage of profits.

The Oregon Shipbuilding Company, Portland, Ore., has received a contract from Hannevig & Johnsen, New York, to build four 8,000-ton steel freight steamships.

The Coastwise Shipbuilding Company, Baltimore, Md., has received a contract to build two 3,000-ton five-masted motor schooners for the Baltimore and Chilean ore trade.

The Coastwise Shipbuilding Company is building two 1,500-ton three-masted wooden barges for the Cook-Cummer Company, Baltimore. The plans for these vessels were drawn by M. C. Furstenau, 308 Walnut street, Philadelphia, Pa.

The Seaborn Shipbuilding Company, Tacoma, Wash., has received a contract to build a 226-foot auxiliary schooner for Norwegian owners.

The Aberdeen Shipyard, Aberdeen, Wash., has received a contract from W. R. Grace & Company, Hanover Square, New York, to build two motor ships. The Aberdeen Shipyard also has a contract to build an auxiliary schooner for Norwegian owners.

The Columbia Engineering Works, Portland, Ore., has rereceived a contract to build a 266-foot auxiliary schooner for build an auxiliary schooner. This is in addition to the three orders already reported.

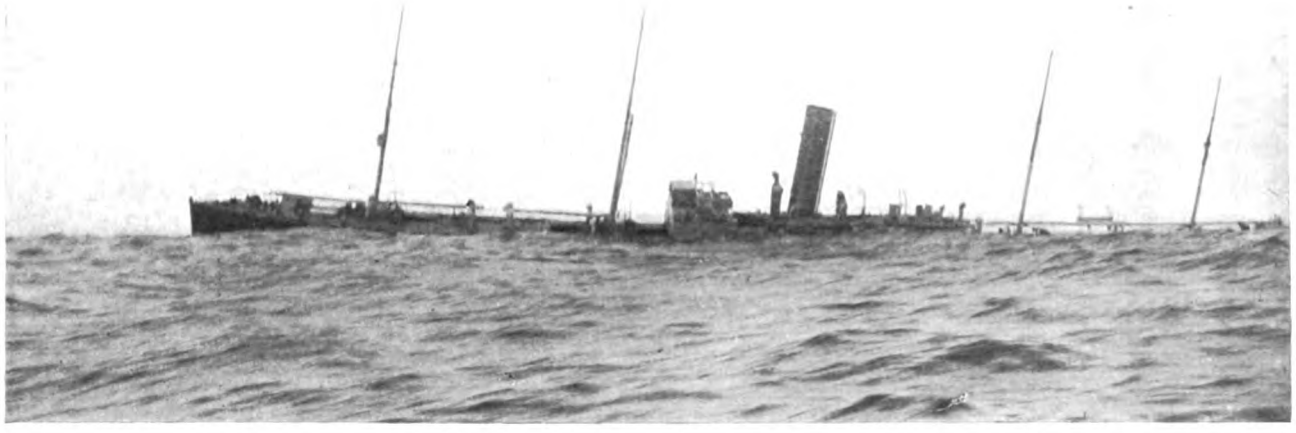
Barbare Bros., Tacoma, Wash., have received a contract to build eleven fishing schooners, at a reported cost of $55,000 each.

The American Dredge Building and Construction Company, Seattle, Wash., has contracts to build three gold dredges.

The Navy Yard, Mare Island, Cal., will build two torpedo boat destroyers of the twenty authorized by the last Congress.

Harry Piaggio, Gulfport, Miss., has given an order for four wooden oil-engined vessels, each to be barkentine rigged.

Generated on 2024-08-12 19:15 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN



(Copyright by Underwood & Underwood, N. Y.)

S. S. *Rowanmore*, British Steamer, on Way to Liverpool from Baltimore, Shelled and Sunk by U-boat on October 26

Shipyard Notes

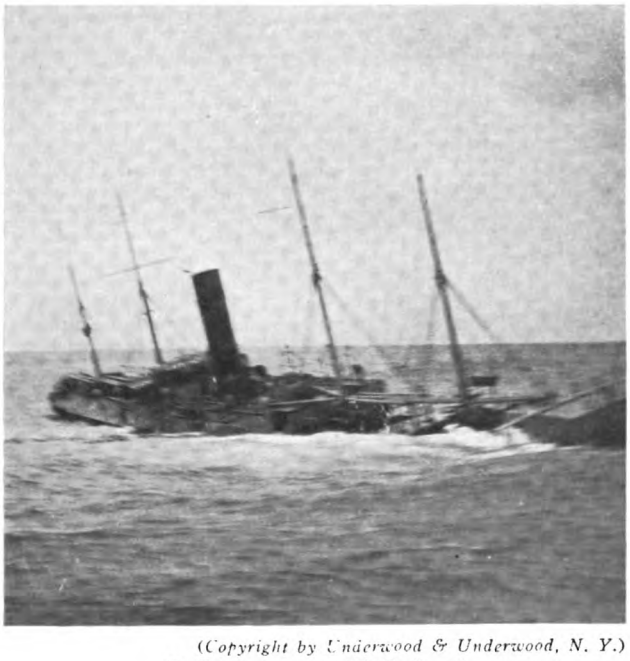
Rear Admiral Harris, chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., has laid before Congress recommendations calling for the remodeling of the principal navy yards of the country and the creation of two completely equipped naval bases. The plan involves an expenditure of from $50,000,000 to $100,000,000, and provides for the equipment of at least eight navy yards for the building of war vessels.

The Navy Department has decided to spend $6,000,000 for the enlargement of the navy yards at Portsmouth, N. H.; Boston, Philadelphia, Norfolk, Charleston and Bremerton. It is planned, when these changes have been made, to build battleships at Norfolk and Philadelphia, cruisers at Boston and Bremerton, and to construct gunboats, destroyers, submarines, etc., at Portsmouth and Charleston.

James Whalen, Port Arthur, Ont., has acquired the American interests in the Western Dry Dock & Shipbuilding Company, at Port Arthur and will make large additions to the plant.

According to newspaper report, Charles W. Morse, head of the United States Steamship Company, 50 Broad street, New York, is making plans to operate a large shipbuilding plant near New London, Conn., with the intention of building eight to ten thousand-ton steel steamers. It is reported that the company has already purchased a 30-acre tract of land near New London.

It is reported that Harry G. Skinner, 1414 Continental Building, Baltimore, Md., will build a shipbuilding yard at Berkeley, Va.



(Copyright by Underwood & Underwood, N. Y.)

S. S. *Rowanmore* Well Awash

Deibert Bros., Elkton, Md., are reported to be planning the establishment of a plant at Havre de Grace, Md., to build barges. It is stated that they have already received contracts to build several barges.

The Ames Shipbuilding & Dry Dock Company, Seattle, Wash., is having plans drawn for a shipbuilding plant by Lee & Brinton, naval architects, Seattle. This company is said to have secured contracts and completed plans to build three steel vessels.

It is reported that the plant of the Spedden Shipbuilding Company, Baltimore, Md., has been sold to A. W. Gieske, Baltimore.

F. C. Hartley, Astoria, Ore., is at the head of a syndicate which plans the establishment of a shipbuilding plant in Seattle and which is said to have already received contracts to build four wooden ships.

The Pacific Coast Shipbuilding & Dry Dock Company, Tacoma, Wash., has been incorporated by J. H. Hyde, Tacoma, Wash, and others, with the intention of constructing a shipbuilding plant and dry dock. The capitalization is $500,000.

The Riter-Conley Manufacturing Company, Pittsburgh, Pa., which has leased the plant of the Ellicott Machine Corporation, Baltimore, Md., is enlarging the capacity of that yard and will build two steel oil tank barges.

The Texas Company, 17 Battery place, New York, will enlarge its plant at Bath, Me., and build a dry dock and machine shop.

The Todd Shipbuilding & Dry Dock Corporation has been organized in Tacoma, Wash., It is stated that 100 acres of land have been purchased in Tacoma and that work will be begun at once on a dry dock.

G. D. Eckstrom and others have established a shipyard at Los Angeles, to be known as the Los Angeles Shipbuilding Company. It is reported that the new concern already has contracts to build three large steamships.

The Hoquiam Shipbuilding Company has been organized at Hoquiam, Wash., to build wooden vessels. Frank H. Lamb is president, F. G. Foster treasurer, and W. R. Marvin manager.

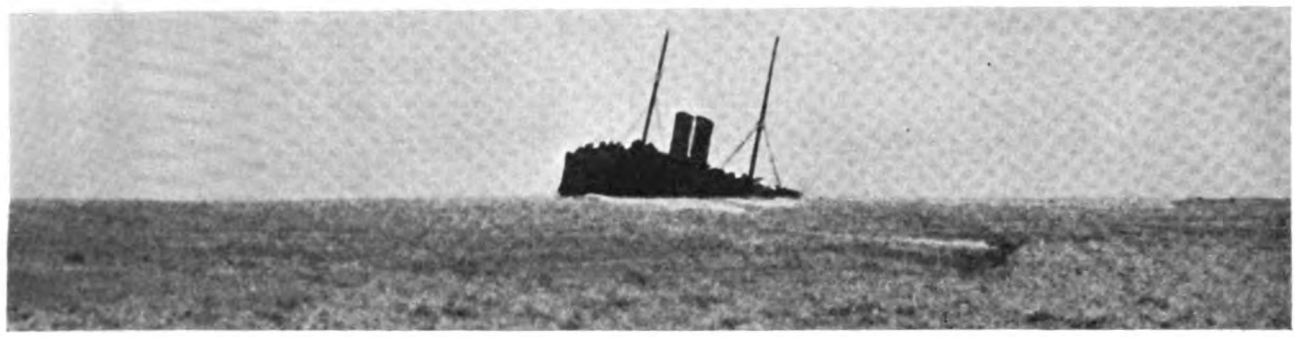
The Slidell Shipbuilding Company has been organized at Slidell, La., to build auxiliary schooners, and it is reported that the company already has orders to build two such vessels.

The Connecticut Marine & Motor Appliance Company has been incorporated, with headquarters in Bridgeport, Conn., by Fred Lepan, Roger O. Foust, both of Milford, Conn., and Thurber R. Chatfield, of Waterbury.

Concrete Dock Patent Upheld in Court of Appeals

A recent decision handed down by the United States Circuit Court of Appeals (October 13, 1916), and affirming a previous decision of the District Court of Eastern Michigan, presents not only striking endorsement of the value of reinforced concrete in dock construction but also recognition of original engineering effort and the engineers' right of patent protection.

Generated on 2024-08-12 19:52 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN



(*Copyright by Underwood & Underwood, N. Y.*)

S. S. *Arabia* Sinking After Having Been Torpedoed by U-boat While Making a Trip Through the Mediterranean

The case was the Detroit Iron & Steel Company against James D. Carey, president of the Cleveland Dock & Engineering Company, Cleveland, Ohio, which owns and exploits a patent granted for a certain type of reinforced concrete dock construction adopted in a dock built for the Detroit Iron & Steel Company.

Quotations from the court decision bring out the following points: (1) Reinforced concrete docks are a proven success. (2) Careful, intelligent design actually saved in the first instance more than 50 percent over the cost of other construction. (3) Recognition has been accorded the engineer and his rights as a patentee upheld.

Marine Terminal Improvements

The New Jersey State Board of Commerce and Navigation, Trenton, N. J., has filed plans calling for an expenditure of $7,234,545, to build a marine terminal at Bayonne, N. J. The plot upon which the proposed terminal is to stand occupies about 420 acres. Plans include dock facilities for modern freight ships and the building of hundreds of lighters and barges.

R. A. C. Smith, Commissioner of Docks, Pier A, North River, New York, has opened bids for extending piers 20 and 21, at the foot of Chambers street.

The Northern Pacific Railway Company, H. E. Stevens, St. Paul, Minn., is planning to spend about $175,000 on a 600-foot addition to its ore dock in Superior, Wis.

C. B. Hegardt, chief engineer, Portland, Ore., is planning the construction of a wharf at Hood River, Ore.

McBride & Law, Beaumont, Tex., have purchased a site on which to build a reinforced concrete wharf.

The Mullen Coal Company, Brighton Beach, Ont., plans to build a 600-foot dock.

A. F. Stewart, chief engineer of the Canadian Pacific Railway Company, Fort William, Ont., is making plans for reinforced concrete docks, to cost about $100,000.

E. D. Aasby, 143 Liberty street, New York, chief engineer of the Lehigh Valley Railroad Company, is planning extensive improvements to pier 6, Jersey City.

The Camden, N. J., Board of Harbor Commissioners is making plans for extensive development of the Camden water front. It is proposed to construct piers and wharves and to build large freight sheds. Information can be obtained from J. Spencer Smith, president of the New Jersey State Board of Commerce and Navigation, Trenton, N. J.

The City of Lake Worth, Fla., is planning extensive water front improvements, including the building of a dock system. Information can be obtained from Isham Randolph & Company, 208 South La Salle street, Chicago, Ill.

The city of New Haven, Conn., F. L. Ford, city engineer, plans a $250,000 bond issue to build a dock.

The city of Atlantic City, N. J., J. M. Hackney, city engineer, is planning to build docks and shipping terminals.

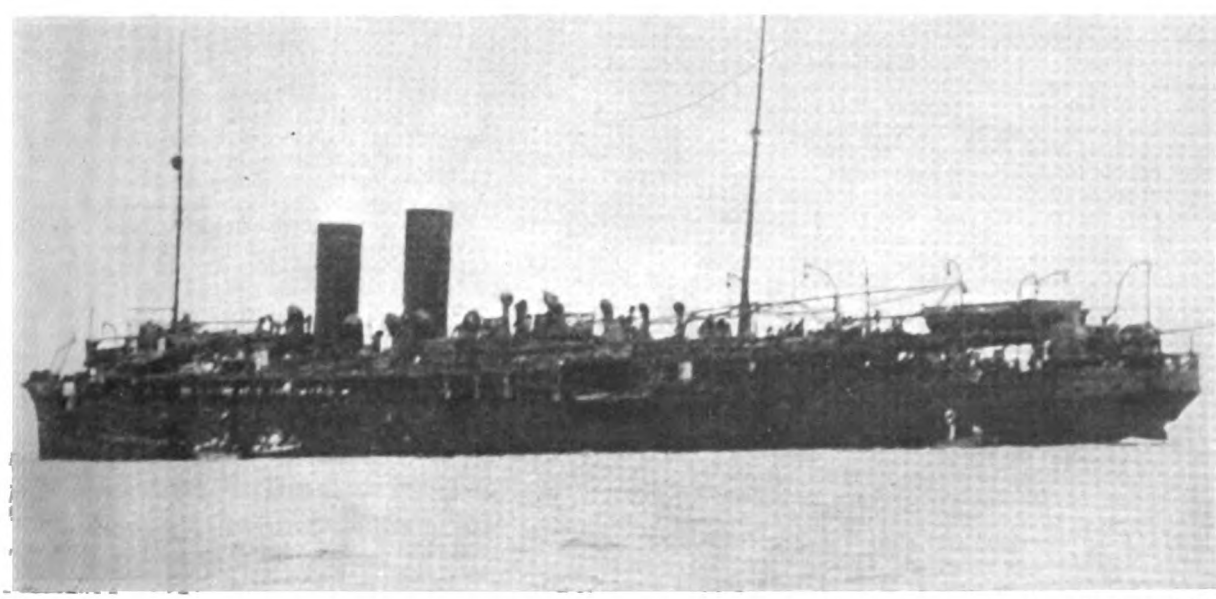
The Chester Shipbuilding Company, Chester, Pa., has given a contract to Latta & Roberts, Drexel Building, Philadelphia, Pa., to build a pier and bulkhead.

The city of Dallas, Tex., J. B. Winsnett, city clerk, has voted an issue of bonds to build a municipal wharf at Lake Charles.

The C. Reiss Coal Company, Superior, Wis., has given a contract for rebuilding and extending its ore docks at an estimated cost of $100,000.

The Canadian Pacific Railway Company, J. C. Sullivan, Winnipeg, Man., chief engineer, is planning to build docks at Vancouver, B. C., at an estimated cost of $1,500,000.

The Atlantic Coast Line Railway Company, Wilmington, N. C., and other companies are planning to spend $100,000 at Jacksonville, Fla., for dockage purposes and similar improvements.



(*Copyright by Underwood & Underwood, N. Y.*)

Passengers and Crew, Numbering 170 Persons, Leaving S. S. *Arabia* After Vessel Has Been Torpedoed by U-boat

Generated on 2024-08-12 19:30 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

The Frank Waterhouse Company, Central building, Seattle. Wash., is planning to spend $300,000 on a dock.

The city of Long Beach, Cal., A. de Ring, city engineer, will vote on a $500,000 bond issue, which sum it is planned to spend on piers.

John E. Matton, Waterford, N. Y., is planning drydocks and sheds to cost about $60,000.

The Axim Transportation Company has been incorporated in Louisville, Ky., by C. R. and C. C. Mengel and C. C. Mengel, Jr.

The new municipal docks at Jacksonville, Fla., comprising two piers, each 1,000 feet in length by 260 feet in width, costing $1,500,000, have been completed and are now ready for business.

The new pier, No. 7, at Cristobal, Canal Zone, which is 1,035 feet long and 212 feet wide, is nearly completed, and cargoes are now being handled at this pier.

It is reported that the Canadian Pacific Railway, Montreal, Canada, will build wharves at Vancouver, B. C., to cost $1,500,000.

The City of St. Louis, Mo., through W. T. Findly, secretary of the Board of Public Service, will build a municipal dock at North Market street to cost about $200,000.

The Bethlehem Steel Company, Sparrows Point, Md., is planning the construction of two 900-foot piers.

The Chesapeake & Ohio Railroad Company, F. I. Cabell, Richmond, Va., chief engineer, plans the construction of a pier at Norfolk to cost about $100,000.

The Minneapolis, St. Paul & Sault Ste. Marie Railroad Company, C. N. Kalk, Minneapolis, Minn., chief engineer, will build an ore dock at Superior, Wis.

The City of Ormond, Fla., G. H. Rigby, mayor, plans a bond issue to build a municipal wharf.

The State Commission of Waterways and Public Lands, Boston, Mass., has appropriated $350,000 for building docks at Fall River.

The United States Government is planning to construct a wharf at Anchorage, Alaska, to cost about $500,000.

The Chicago & Northwestern Railroad Company, Chicago, Ill., which is building a frame ore dock at Ashland, Wis., is planning the construction of another dock to be built of concrete and steel.

The Chesapeake & Ohio Railway Company, J. P. Stenem, general manager, Richmond, Va., is planning to extend piers No. 3 and 12, at a cost of about $50,000.

The Edison Electric & Illuminating Company, 39 Boylston street, Boston, Mass., has let a contract to extend its wharf and bulkhead to the W. L. Miller Company, 171 Alford street, Charleston, Mass. Cost about $40,000.

The City of Seattle, Wash., C. D. Calley, 1525 Thirty-second avenue, Seattle, bridge engineer, is planning to build a dock.

Diesel Tanker Overhauled at Newport News Shipyard

In November, 1912, the motor-driven tanker *Juno* was placed in service and she was equipped with the first high-powered reversible Diesel engine that the Werkspoor Company, of Amsterdam, built for marine purposes—this motor being of 1,100 brake horsepower (1,460 indicated horsepower at 115 revolutions per minute, with mechanical efficiency of 78 percent, and a mean effective pressure of 105 pounds per square inch), or equivalent to about 1,300 steam indicated horsepower.

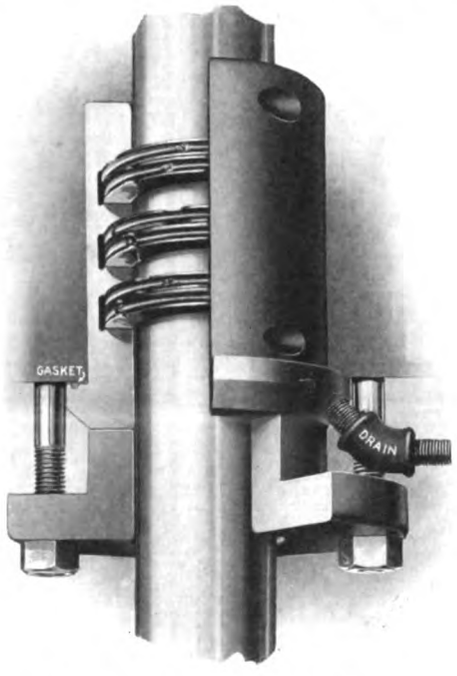
This ship has recently been docked at Newport News to have the Lloyds No. 1 Survey, which takes place at the end of four years' service. According to Mr. Charles Bailey, chief engineer of the Newport News Shipbuilding and Dry Dock Company, a thorough examination was made of the hull and machinery, but very little work on the engine was found necessary. One of the company's engineers accompanied the *Juno* to the Capes, and reported the running of the machinery as very satisfactory.

The *Juno* is of 4,300 tons displacement, and carries about 2,500 tons of cargo, on a deadweight capacity of 2,675 tons, at an average loaded speed of 9¾ knots, and with a fuel consumption of a little under 5 tons of crude oil per day. Her engine has six cylinders, 22-inch bore by 39⅜-inch stroke. Her engine room staff consists of chief, first, second and third engineers, four oilers and two cleaners. The lubricating oil consumption is about 20 gallons per 24-hour day. The vessel's length between perpendiculars is 258 feet, with 45 feet beam and 18½ feet draft, and her trial speed was 10½ knots. Her owners are the Anglo-Saxon Petroleum Company, of London.

It may be remembered that with the old design of Werkspoor-Diesel engines there was not considered enough space between the valves for cooling purposes, and about a year ago a new cylinder design was produced in which there is at least four inches of cooling water between every valve, and this was found to be so faultless that the builders were not contented with adopting it for new engines, but fitted the new design of cylinder to some of the older vessels in service. *Juno* was one of these ships, and having new cylinders, new pistons naturally were required, and the opportunity was taken to use the latest design. A section of crankshaft also was fitted. This was at the beginning of the year, since when the engine has been running splendidly, and goes to prove how necessary is seagoing experience to produce a satisfactory design of marine Diesel engine.

Martell Metallic Packing

The illustration shows a metallic packing arranged for marine service, which is manufactured by the Martell Packings Company, Elyria, Ohio. The packing rings, of cast iron or bronze, are in a split case enclosed in the stuffing-box. The regular gland is retained, but simply holds the gasket in the



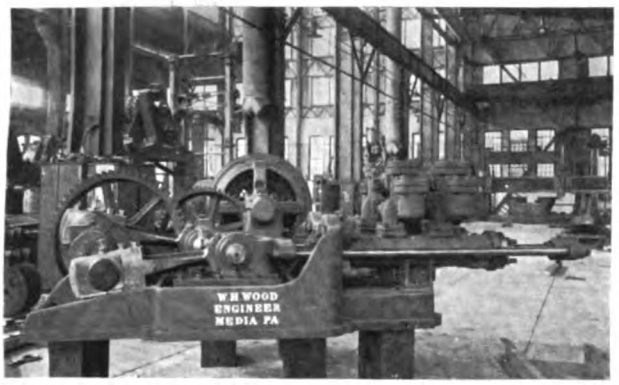
outer flange firmly against the face of the stuffing-box. Retention of the regular gland in working position seems to give the engineer a greater sense of security, although no case has ever occurred where fibrous packing had to be substituted for the metal parts. It is plain, however, that this could be done in a very few minutes if it should be necessary. The feature of the small flange intervening between the gland and the stuffing-box is unique, and has a number of advantages, the most important being that it allows the use of a properly proportioned drain pipe to take care of condensation; secondly, it brings the gasket where it is readily accessible, and there is no danger of the packing becoming fast in the stuffing-box. The fact that the manufacturers of this packing can successfully pack a 6-inch rod with but 3 inches of longitudinal or vertical space is of special interest to the marine engine designer, as the possibility of either increasing length of the connecting rod or establishing a lower center of stability in the hull is thereby made possible. In packings of this type the friction is entirely negligible, and the use of lubrication is practically eliminated.

Hydraulic Horizontal Pressure Pumps for Puget Sound Navy Yard

Two sets of double-acting horizontal pressure pumps with water plunger 2⅞ inches diameter by 12-inch stroke, driven by 100-horsepower electric motors, furnished by the General Electric Company, have been designed and built for installation at the Puget Sound navy yard, Washington, by William H.

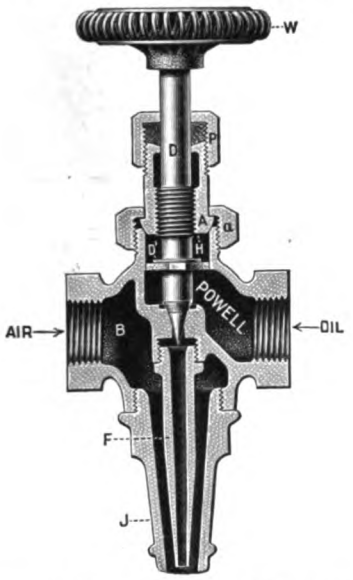
Generated on 2024-08-12 19:23 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN

Wood, Media, Delaware county, Pa. On the end of the motor shaft for driving the pumps is a rawhide pinion working through compound gearings, so as to give the pumps a capacity to deliver 75 gallons per minute against 1,800 pounds pressure, or 60 gallons per minute against 2,000 pounds pressure. These pumps are to work with one of William H. Wood's hydraulic accumulators with 16-inch plunger and 15-foot stroke.



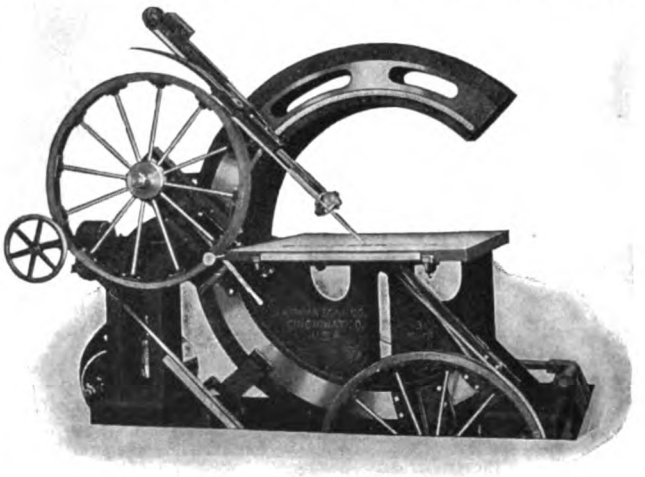
Powell Oil Burner Valve

The William Powell Company, Cincinnati, Ohio, has placed on the market the oil burner valve illustrated, which is the result of special tests for proportioning the oil tubes and air nozzle so as to produce the maximum amount of heat with a minimum amount of oil and air. The stem is machined with a needle point and fine thread, permitting a close regulation of oil. The oil tube has a long, taper point, adapted for the close control and economy of oil, while the air nozzle is of heavy construction, especially proportioned to meet the general conditions as a spray or atomizing transmitter. It is claimed that the free and unobstructed passage of the oil will not clog or interfere with the proper flow, and can be used in connection with compressed air, blowers, fan-blast or steam.



"Lightning" Band Ship Saw

The No. 311 "Lightning" band ship saw illustrated, which is manufactured by J. A. Fay & Egan Company, Cincinnati, Ohio, is designed for extra heavy band sawing, both straight and curved work. The blade can be set at any angle by power or hand while it is sawing, making the machine particularly valuable in shipbuilding work. The machine saws to any angle in a full semi-circle, the wheels being carried on a housing mounted on roller bearings and angling 45 degrees to right or left by power, with hand wheel adjustment for extremely fine setting. The angling mechanism is carried on an auxiliary column at the rear. The table measures 48 by 48 inches, and is mounted perfectly rigid on the main column, so that it is always level. The wheels are 48 inches diameter by 3 inches face, carrying blades up to 3½ inches wide. As the wheels move simultaneously, and always in the same plane, the cutting point of the blade is always at the same point on the table line regardless of the angle of the blade. Power is furnished by a 15-horsepower motor belted to the main driving pulley.



PERSONAL

C. A. MASTERS, treasurer of the Alaska Steamship Company, Seattle, Wash., has resigned to become president and managing director of the Washington Shipbuilding Company, Tacoma, Wash., recently incorporated.

ANDREW FLETCHER, president of the W. & A. Fletcher Company, Hoboken, N. J., ship and marine engine builders, has been elected president of the American Locomotive Company, New York. Mr. Fletcher is also a director of the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.; president of the Consolidated Iron Works and the North River Derrick Company, and a director in several banks in Hoboken.

CHARLES P. SUMNER, dean of the transatlantic steamship agents, and for many years general agent of the Cunard Line, first in Boston and more recently in New York, retired on December 31. Mr. Sumner's successor is Mr. T. Ashley Sparks, a partner in the firm of Funch, Edye & Company, agents of the Commonwealth & Dominion Line in New York.

OBITUARY

WILLIAM C. WILLIAMSON, founder of the firm of Williamson Bros. Company (now the American Engineering Company), of Philadelphia, Pa., and originator of the steam steering gear in the United States, died in Philadelphia on December 2, aged 80.

CAPT. C. B. PARSONS, former president of the Maritime Exchange of New York, died in New York on December 22, aged 82. Captain Parsons had long been a prominent figure in marine circles. During the Civil War he served in the Engineer Corps. After the war he was in command of various vessels engaged in the coastwise and West Indian trades, retiring from the sea in the late eighties to engage in ship brokerage as partner in the firm of B. T. Betty & Company, New York.

MISSISSIPPI RIVER FREIGHT LINE.—The Kansas City-Missouri River Navigation Company, which operates a freight line on the Missouri River between St. Louis and Kansas City, handled a tonnage of over 18,000 tons inbound and outbound freight over the municipal wharf in Kansas City during the past season. This is an increase of 10 percent over the inbound freight hauled in 1915, but there was a falling off in outbound freight due to the embargo and freight congestion on Eastern lines. This winter the company is trying an experiment in hauling freight between St. Louis and New Orleans. As the equipment includes weather-proof, fireproof steel barges and towboats, high-class freight is especially solicited. No other freight line on the Mississippi River is competing for this class of freight.

Generated on 2024-08-12 19:50 GMT / https://hdl.handle.net/2027/mdp.39015080010682
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF MICHIGAN